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TRANSLUMBAR ARTERIOGRAPHY: ITS ROENTGENOLOGIC INTERPRETATION*†

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TRANSLUMBAR arteriography was first performed by dos Santos, who reported his experiences before the Surgical Society of Paris in 1929. His monograph on the subject[10] reveals the thoroughness of his application of this technique. However, because the value of arteriography was not appreciated, and because aortic puncture appeared dangerous, the procedure did not receive wide acceptance.

In a previous communication,[30] we have shown that the hazards of aortic puncture have been overemphasized. Up to the present time, we have performed more than three hundred translumbar aortic punctures without a single significant complication. These were carried out, in many instances, on patients with advanced arteriosclerosis and/or hypertension. One patient, despite a blood pressure of 300/200, tolerated the procedure without incident. Further evidence of the lack of danger and the simplicity of the technique is the fact that a number of different individuals, often inexperienced in the procedure, performed the aortic punctures in this series.

Our technique, which stresses simplicity, is modified from that of dos Santos,[11] and has been previously published.[31] The equipment consists of a 10 cc. Sana-Lok control syringe with plastic tubing, two Luer-Lok adapters, and a specially made 18 gauge, 6 inch needle. The procedure is performed under sodium pentothal anesthesia with the patient prone. The needle is inserted into the back below the twelfth rib on the left side, and enters the aorta in the region of the twelfth thoracic vertebra. Twelve cubic centimeters of 75 per cent neoiopax or 70 per cent diodrast are injected into the aorta, by hand, in a period of about two seconds. A Potter-Bucky roentgenogram of the abdomen is then made with an exposure time of 0.2 second. For visualization of the upper abdominal aorta, the exposure is made as the last cubic centimeter leaves the syringe; for the lower abdominal aorta, a corresponding delay in the exposure is required. A second film is exposed about four seconds after the first. On several occasions, a rapid cassette changer, making one exposure every

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FIG. 1. The normal arteriogram, demonstrating hepatic, splenic, renal and intestinal arterial circulation.

half second, was used. This particular instrument has not proved satisfactory in our experience because the film detail has not been adequate and the film size is too small. However, our experience indicates that a multiple film technique has merit. We are continuing our studies in this direction.

The purpose of the present communication is to relate our experiences in the interpretation of translumbar arteriograms. This report is based upon a study of 200 selected arteriograms performed on 175 patients, of whom 79 were males and 96 females. The youngest patient was eleven years of age and the oldest, eighty-one. Since many of these patients were selected because of the likelihood of demonstrating an abnormal arteriogram, this material does not represent a true cross section of our urological service.

There were 50 normal arteriograms and 120 abnormal ones. Thirty were considered unsatisfactory because of extra-aortic injection, poor timing of the exposure, poor technical quality of the roentgenograms, and failure of the injection equipment. As experience has accumulated, the percentage of failures has greatly decreased.

THE NORMAL ARTERIOGRAM

A thorough knowledge of the anatomy of the abdominal aorta and its branches is essential for the accurate interpretation of the arteriogram. Figure 1 illustrates a normal arteriogram. It is apparent that superimposition of the vessels may occur and,

FIG. 2. The normal renal arterial pattern.

FIG. 3. The celiac artery (*1*) and its branches: (*2*) the splenic, (*3*) the left gastric, (*4*) the right gastric, (*5*) the hepatic, (*6*) the gastroduodenal, (*7*) the superior pancreaticoduodenal, and (*8*) the right gastroepiploic.

undoubtedly, stereoscopic films should be helpful in more accurately identifying the various branches, although we have had little personal experience with them.

Occasionally, contrast medium is accidentally injected directly into a branch of the aorta. This has afforded us an excellent opportunity to better visualize the detailed arterial distribution of the renal, celiac, and superior and inferior mesenteric arteries (Fig. 2, 3, 4, and 5). No harmful sequelae have resulted from ten such injections in our series, but we know of 3 cases in which direct injection into the superior mesenteric artery resulted in mesenteric infarction and death.[8,29,35]

A detailed knowledge of the normal renal arterial circulation is of particular importance. Graham[15] described the arterial circulation of the kidney as shown on roentgenograms of autopsy specimens which were made following the injection of contrast substance into the renal artery. He found that the primary division of the renal artery occurs just within or close to the hilus; that the vessels then show a gradual diminution in size as they spread through the kidney; that the smaller renal branches arise at an acute angle; and that the interlobar and arcuate branches pass between the pyramids, and then spread out in graceful curves in the cortex.

The injection of diodrast or neo-iopax into the aorta also results in a varying degree of diffuse opacification of the kidney parenchyma or nephrogram (Fig. 6). This appearance is best shown on the film made a few seconds after the injection has been completed, although it is often observed on the film exposed during the

Fig. 4. The superior mesenteric artery (*1*) and its branches: (*2*) the middle colic, (*3*) the pancreaticoduodenal inferior, (*4*) the right colic, (*5*) the ileocolic, (*6*) the jejunal, and (*7*) the ileal.

Fig. 5. The inferior mesenteric artery (*1*) and its branches: (*2*) the left colic, (*3*) the sigmoidal, (*4*) the right hemorrhoidal, (*5*) the left hemorrhoidal, and, in addition, (*6*) the left spermatic artery.

FIG. 6. The normal nephrogram.

injection. It is reported[4] that the use of 80 per cent sodium iodide does not produce this appearance.

We have also occasionally noted a similar opacification of the spleen. In one case, opacification of the wall of the colon occurred following direct injection into the superior mesenteric artery.

THE ABNORMAL ARTERIOGRAM

RENAL ANOMALIES

1. *Anomalous Renal Artery.* One of the more common causes of ureteropelvic obstruction is the anomalous renal artery. This vessel may arise either directly from the aorta, or as a branch of the main renal artery. As it passes toward the lower pole of the kidney, it may compress the ureter, producing obstruction. In the present series, an anomalous renal artery was demonstrated by arteriography as the cause of hydronephrosis in 9 cases, and was confirmed in each. The anomalous vessel arose directly from the aorta, 2 to 4 cm. distal to the main renal artery in 5 cases, and branched off the renal artery in 4 cases. The aberrant vessel was invariably smaller than the main renal artery. On the pyelogram, a notch in the ureter was usually apparent at the site of crossing of the anomalous artery, and the pelvic dilatation was confined to the region proximal to it. This was especially well shown when intravenous pyelography immediately preceded the arteriogram (Fig. 7, *A* and *B*). Retrograde pyelography may also be utilized for this purpose if the contrast medium is very dilute.

Anomalous vessels were demonstrated in association with normal pyelograms in 8 cases. Some of these patients had unexplained pain which suggested renal origin, but the relationship of pain to aberrant renal artery is beyond the scope of this article. Anomalous renal arteries are also commonly found in association with other congenital abnormalities of the kidney. These will be discussed later.

While the presence of an anomalous renal artery can usually be determined at operation, arteriography informs the surgeon, in advance, how much the anomalous vessel contributes to the circulation of the kidney. He can then determine more readily whether the vessel should be divided or a pyeloplasty performed around it. Doss[6] has pointed out that more of the arterial structure of the kidney can be learned from the arteriogram than at the operating table.

2. *Congenital Malposition.* There were 10 cases of malposition of the kidney, including 2 cases of right crossed ectopia. In 1 of these, four renal arteries arose from the right side of the aorta, three entering the lower pole of the fused kidneys to supply the lower half, and one entering the upper pole to supply the upper half (Fig. 8). In striking contrast, the other case showed a single renal artery arising from the aorta, entering the hilus of the upper kidney, and branching throughout both kidneys, thus accounting for their entire arterial supply.

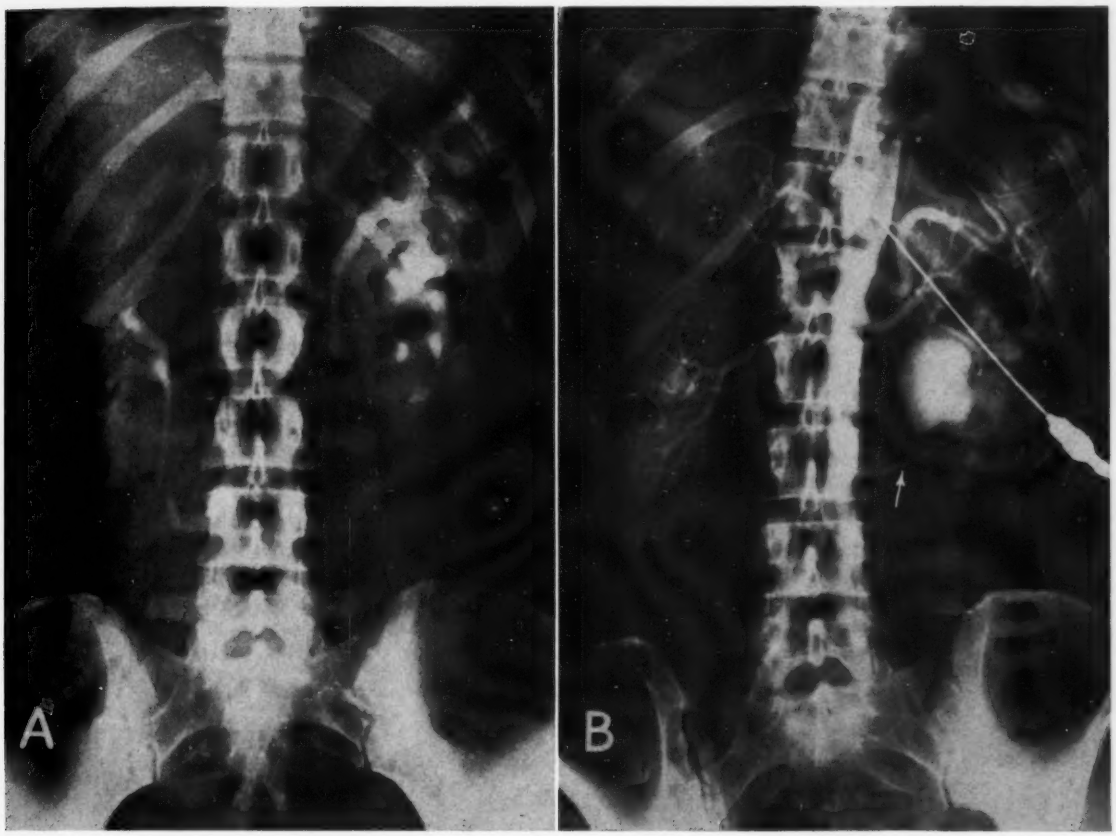

Fig. 7. (*A*) An intravenous pyelogram demonstrating a double left renal pelvis. (*B*) The arteriogram combined with an intravenous pyelogram illustrates one renal artery supplying the major portion of both kidneys and a left lower pole aberrant artery producing hydronephrosis.

Two cases presented a low ectopic kidney. In each instance, a single renal artery arose in a normal position from the aorta, and extended obliquely downward to supply the ectopic kidney. Consequently, the renal pedicle was unusually elongated.

The remaining 6 cases presented malrotated kidneys. Two to four renal arteries supplied the abnormal kidney in each instance. In 1 case, three arteries arose from the aorta and one from the common iliac (Fig. 9).

It is interesting that in most of these cases of congenital malposition the nephrogram was exceptionally dense. The reason for this is not apparent.

Although none of the cases in this group presented surgical indications, operative procedures on malposed kidneys are frequently necessary. In such cases, arteriography will supply advance information concerning the blood supply to the kidney (the length of the vascular pedicle, the number and location of the renal arteries, etc.) which may facilitate surgical correction and obviate accidental severance of anomalous vessels.

3. *Horseshoe Kidney.* This anomaly was encountered in only 2 cases in the present series. In both, a single right and two left renal arteries were present. A third case of horseshoe kidney, of which the left half had been previously removed, showed a single right renal artery. The renal arterial branching and the nephrogram were normal in each of the 3 cases, and no evidence of circulation across the isthmus of the horseshoe was seen. Arteriography may prove useful in those cases of horseshoe kidney in which operation is indicated,

FIG. 8. A right crossed, fused renal ectopia demonstrating four renal arteries, of which three enter the lower kidney and one, the upper. (Retouched.)

since it will reveal the length of the renal pedicle and the number and location of anomalous vessels.[23]

4. *Renal Duplication.* Five cases of double pelvis and ureter were encountered in the present series. In 4 of these, two renal arteries arose from the aorta to supply the duplicated kidney. In the fifth case, a single renal artery arose from the aorta and divided into two branches in the hilus of the kidney. In none of the cases were the two branches of equal size, nor did they supply equal portions of the kidney. In fact, there appeared to be no relationship between the distribution of the two renal arteries and the division of the kidney pelvis (Fig. 7*B*). Therefore, if heminephrectomy is indicated in such a case, the site of incision can be planned more accurately if arteriography has been employed.

5. *Renal Hypoplasia and Agenesis.* Five cases of congenital hypoplasia of the kidney were studied. None of these patients had hypertension. Arteriography showed a small renal artery with minute branches in each instance (Fig. 9). The circulation of these kidneys was therefore commensurate with their size. In each case, intravenous pyelography revealed no function of the abnormal kidney, and the renal outline could not be seen. However, in 2 of the 5 cases a very small kidney was demonstrated on the nephrogram. In both of these cases, the ureter was too small to catheterize.

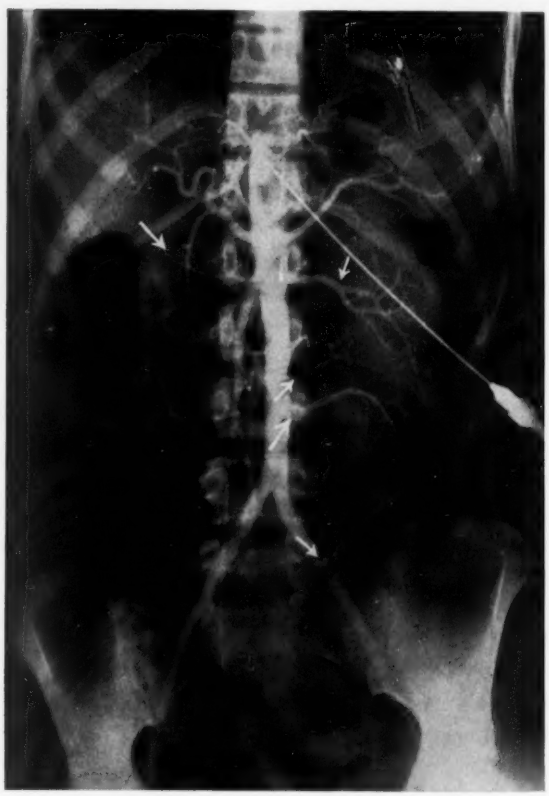

FIG. 9. A malrotated left kidney with four renal arteries supplying it. The small right renal artery supplies a hypoplastic kidney.

One patient with proved agenesis of the kidney was seen. Intravenous pyelography showed no contrast medium on the right side and a ureteral catheter could not be passed. Arteriography showed no evidence of a right renal artery.

Arteriography is of particular value in those cases of renal hypoplasia in which retrograde and intravenous pyelography are unsuccessful in demonstrating the kidney.

Impaired Renal Circulation

All cases of hydronephrosis, including those due to anomalous vessels, were studied from the standpoint of the arterial supply to the diseased kidney. Hydronephrosis of varying etiology was encountered in 42 kidneys (35 patients). Arteriography showed a normal main renal artery in 28, varying degrees of diminution of caliber in 7, and unsatisfactory visualization in 7. The intrarenal branches were normal in 19 instances, showed varying degrees of diminution in 20, and were not visualized because of technical reasons in 3. In each case in which the main renal artery was of small caliber, its branches were also fewer in number than normal.

Studies with the rapid cassette changer, by means of which two films per second were exposed, were made in 5 cases. These showed that the degree of arterial filling in the kidney varied considerably from film to film. It was therefore apparent that impaired renal circulation as shown on the single film arteriogram had to be interpreted cautiously. However, it was usually possible to distinguish between actual decreased circulation and incomplete filling by studying the terminal branches of the renal artery. If they were clearly seen and moderately opaque, yet spread apart and few in number, the circulation was considered impaired.

Three cases of severe non-tuberculous renal infection, without hydronephrosis, were included in the study, and 2 showed a distinct decrease of circulation in the parenchyma. One patient with advanced renal tuberculosis showed a normal arteriogram.

Of 16 cases of renal lithiasis, 12 also showed hydronephrosis and were included in that group. Two of the remaining 4 cases showed a normal arteriogram, and the other 2 showed impaired renal circulation due to advanced infection.

Fig. 10. The left ureter was obstructed by an impassable calculus. An arteriogram demonstrates equal blood supply to both kidneys and, therefore, a potentially normal left kidney is present. (Retouched.)

Replacement of the normal renal parenchyma by hydronephrosis and/or infection will obviously cause a decrease in the arterial circulation in the kidney. Assuming that the amount of circulation in the kidney is an important reflection of its function and of its ability to recover from certain pathological processes,[13] then arteriography should be of help in making decisions concerning nephrectomy. Doss,[7] in a study of 8 cases of hydronephrosis, performed nephrectomy in 4 because of impaired renal circulation demonstrated on the arteriogram. Pathological study in each case revealed hopelessly far-advanced changes. In 3 cases which showed a normal renal circulation on the arteriogram, the obstruc-

FIG. 11. The right ureter was obstructed. The arteriogram revealed diminished right renal blood supply. Nephrectomy revealed a completely fibrotic renal parenchyma.

tion was corrected but the kidney left intact. In each of the 3, there was a reasonably good return of function. One patient with poor renal circulation refused surgery.

Since the duration of the follow-up period in our material is brief, we have been unable to draw definite conclusions concerning the value of arteriography in such cases. Our experience has tended to confirm Doss's opinions. In the case illustrated in Figure 10, the left lower ureter was obstructed by a calculus. Intravenous pyelography revealed no function on the left, and a ureteral catheter would not pass by the calculus. Arteriography showed a normal renal circulation on the left. The ureteral calculus was removed at operation, and examination six months later showed normal renal function and a normal pyelogram. The patient shown in Figure 11 had a right ureteral obstruction and no function of this kidney on the intravenous pyelogram. Arteriograms showed very poor circulation to the right kidney. At operation, the kidney was removed and showed complete destruction of the parenchyma. In a number of other cases, nephrectomy was performed on kidneys which showed poor arterial circulation. In every instance, gross and microscopic examinations indicated severe kidney damage. It appeared unlikely that such kidneys could have shown a significant degree of recovery had they not been removed. Further study of this problem is being made.

There were many patients in the group who were being studied for possible renal origin of hypertension. No instance of the Goldblatt type of kidney was encountered. Nelson[24] performed arteriography on a patient with atrophic pyelonephritis and hypertension. Obstruction of the main renal artery with collateral circulation was shown. He believed that this patient had a Goldblatt type of kidney.

ARTERIAL DISEASE

1. *Aneurysm.* In the present series, aneurysm of the abdominal aorta was demonstrated in 1 patient (Fig. 12), and splenic artery aneurysm in 2 cases (Fig. 13). Visualization of aneurysms by translumbar arteriography has been occasionally reported by others.[10,26,34]

2. *Arterial Thrombosis.* Thrombosis of the abdominal aorta, as described by Leriche,[20] has been demonstrated by catheter aortography in 1 case at the Cincinnati General Hospital.[18] However, aortic and iliac thromboses have also been visualized by means of translumbar arteriography.[20,21,22,28]

3. *Infarction.* Four cases of proved renal infarction occurred in our series. In 1 of these (Fig. 14), arteriography showed an abrupt termination of several of the smaller renal branches, with depressions in the renal cortex corresponding to the obstructed arteries. The depressed areas appeared as filling defects on the nephrogram, and conformed to the location of the in-

Fig. 13. A splenic artery aneurysm.

farcts seen in the specimen. The second patient, who had no hypertension, showed extensive calcification in the left renal artery with almost complete occlusion of this vessel on the arteriogram. The nephrogram showed minimal density of the left kidney. At operation, the left renal artery was nearly completely occluded and the

Fig. 12. An abdominal aortic aneurysm.

left kidney extensively infarcted. The third case showed decreased circulation in the peripheral portion of the right kidney on two separate arteriograms, and autopsy showed multiple large renal infarcts. In the fourth case, the arteriogram and nephrogram were normal, and the specimen showed multiple minute infarcts.

Fig. 14. Right renal infarcts proved by surgery. Arrows indicate abrupt terminations of the obstructed arteries.

Graham,[15] from his injection studies of autopsy specimens, described ragged, irregular, peripheral defects in the circulation pattern in renal infarction. We have not encountered any other discussion of renal infarction in the literature on arteriography.

Arteriography in Pregnancy

Coutts and his co-workers[3] performed arteriography on 12 pregnant women. They described displacement of the aorta and its branches, and several instances of filling of some of the placental arteries. Hartnett[17] performed the procedure on 68 pregnant women. He described a characteristic mottling of the maternal sinuses which made it easy to identify the placenta, and reported 2 cases of placenta previa demonstrated in this manner.

In our series, arteriography was performed on 5 pregnant women near term. The examination was unsatisfactory in 2 of the cases, while the placenta was faintly demonstrated in the other 3 cases. In 1 of the latter group, a suspected placenta previa was ruled out by this method. Further studies in this field are continuing.

FIG. 15. Pooling of contrast medium in the region of a left renal space-consuming lesion which proved to be a hypernephroma.

Abdominal Masses

1. *Renal Tumors.* There were 7 cases of proved renal malignancy in the series. In the 5 instances of hypernephroma, the contrast medium collected in irregular pools in the substance of the tumor on the arteriogram (Fig. 15). This pooling was barely perceptible in 2 patients with small tumors, but was quite obvious in the other 3 cases. No other consistent vascular abnormalities were detected.

In the 2 cases of transitional cell carcinoma of the renal pelvis, both of which had invaded the parenchyma, no pooling was visible, and the arterial circulation in the region of the tumor was diminished.

Pooling of contrast medium in hypernephroma has been noted by many authors.[1,5,23,24,34] Nelson[25] reported 2 cases in which pyelograms were essentially normal and hypernephroma was correctly diagnosed from the pooling seen on the arteriogram. Although Melick and Vitt[23] stated, "We are beginning to believe that massive and extensive pooling denote an inoperable tumor," this has not been our experience.

Similar pooling has been described in a suprarenal tumor[24] and in a carcinoma of the sigmoid.[10] One case of carcinoma of the ascending colon in the present series failed to show this finding.

A diminished arterial supply and absence of pooling has been described in primary carcinoma of the renal pelvis.[5] As more experience is accumulated, it is possible that arteriography may prove to be an aid in the differentiation between hypernephroma and carcinoma of the renal pelvis.

2. *Solitary Renal Cyst.* There were 7 cases of proved solitary cyst of the kidney in the series. In each case, the correct diagnosis was made from the arteriogram,

which showed absence of circulation in the region of the renal mass in all cases, spreading of the vessels around the mass in 3, and filling defect on the nephrogram in 2 cases (Fig. 16). Similar findings have been reported by others.[5,23]

3. *Polycystic Kidney.* There were 5 cases of polycystic disease studied, 4 of which were ultimately proved. In 2 cases, arteriography showed definite spreading of the

Fig. 16. An avascular area on the arteriogram in the lower left renal pole, in a patient with a corresponding renal space-consuming lesion which proved to be a solitary cyst. (Retouched.)

smaller intrarenal arteries around the cysts (Fig. 17). In the other 3 cases, close inspection of the films showed minimal curving of the smaller branches around the cysts, but the deviation from normal was slight. The arterial circulation in the kidney was greatly decreased in 2 patients who died of renal insufficiency a month after arteriography. The renal circulation was

Fig. 17. An arteriogram of a patient with polycystic kidneys. Intrarenal spreading and circling of the cysts by the arteries is present. (Retouched.)

moderately decreased in 2 cases and was normal in 1 case. In the 3 cases in which a nephrogram was available, the cysts were visible as distinct filling defects in 1, and as faint defects in 2 cases.

The multiple small cysts of early polycystic kidneys are difficult to demonstrate by means of arteriography. When larger cysts are present, the arteriogram will sometimes show a typical appearance. However, the pyelogram has usually established the diagnosis in such cases. Therefore, arteriography has not proved to be of much help in the diagnosis of polycystic kidneys.

4. *Other Abdominal Masses.* Only 5 patients with abdominal masses of extrarenal origin were studied. In 2 cases, the splenic artery was visualized entering the mass and branching within it, thus establishing that the tumor was an enlarged spleen.

In 1 case, a pulsating mass was thought to represent an aortic aneurysm, but arteriography showed a normal aorta. A pseudocyst of the pancreas was found at operation. The other 2 cases proved to be carcinoma of the liver and colon, respectively, and the arteriograms were normal in both instances.

Arteriography may prove to be of considerable importance on the localization of abdominal masses.[12] The origin of a mass in kidney, spleen, or aorta is readily established or ruled out by this method. Also, the type of displacement of the normal arterial pattern may give an excellent clue to the location of the mass.[10]

DISCUSSION

Our original purpose in performing translumbar arteriography was to study the renal arterial circulation in various urological conditions. Therefore, all types of cases were examined in order to establish the normal and abnormal arterial patterns. It soon became apparent that, as others had noted, arteriography offered an apparently safe diagnostic method, and often aided the surgeon in planning his operative procedure.

At the present time, we believe that arteriography is of definite value in the diagnosis of arterial obstruction, aneurysm of the abdominal aorta or its branches, and left upper quadrant abdominal masses. It is also of aid in the diagnosis of anomalous renal artery, and in the determination of the portion of the kidney supplied by the aberrant vessel. In addition, arteriography is the best means of obtaining preoperative information about the nonfunctioning kidney with impassable ureteral obstruction. Further experience, we believe, will substantiate that arteriography is useful in the differentiation between renal cancer and cyst, in the demonstration of placenta previa, and in determining the indications for nephrectomy in cases of severe hydronephrosis and/or infection.

Experience is required for the proper interpretation of the arteriogram. Careful correlation of the arteriographic with the pathological findings is indispensable. As our study has progressed, we have developed a measure of confidence in our ability to evaluate the arteriogram. Nevertheless, because of our limited experience with certain conditions, our conclusions have often been guarded. For example, although the present study seems to indicate that it is possible to differentiate between renal cyst, hypernephroma, and transitional cell carcinoma of the pelvis, we still operate upon all space-consuming lesions of the kidney.

The significance of the nephrogram is difficult to estimate. The degree of density attained by the kidney parenchyma following arteriography does not correlate with the renal function, as shown by clinical and pathological studies in our material. While it is apparently true that the presence of opacification of the kidney parenchyma on the nephrogram indicates that the kidney is not completely functionless, absence of such opacification is sometimes noted in normal kidneys and therefore does not always indicate lack of function. However, the nephrogram has often been of considerable help in revealing, as filling defects, functionless areas within the kidney parenchyma.

The only contraindications to arteriography which we have heeded have been iodine sensitivity and uremia. As previously stated, old age, severe arteriosclerosis, and hypertension have not been regarded as serious risks. The absence of complications in more than three hundred injections indicates that the procedure is more than reasonably safe.

Improvements in certain technical aspects of arteriography will undoubtedly increase the value and scope of the procedure. A more satisfactory rapid film changer, and a safer radiopaque medium which will permit the injection of larger quantities and obviate the need of general anesthesia, are two such developments which would be very desirable. However, even with the present technique, arteriography has proved to be a relatively simple and safe procedure which offers valuable

preoperative information obtainable in no other manner.

SUMMARY

1. More than three hundred translumbar arteriograms have been performed without complications.

2. The technique of the procedure is briefly described.

3. The normal arteriogram is described and illustrated.

4. Experiences with arteriography in two hundred of the cases is reviewed. The findings in renal anomalies, cysts and tumors of the kidney, other abdominal tumors, hydronephrosis, pyelonephritis, arterial aneurysm and thrombosis, and pregnancy are described, and the value of the method in each of these conditions is discussed.

5. It is concluded that translumbar arteriography is relatively safe and simple, and that it offers valuable preoperative information which is not obtainable by any other means.

ADDENDUM

Since this paper was submitted, about five hundred more arteriograms have been performed by the authors, making a total of about eight hundred. No fatality has occurred.

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DISCUSSION

DR. ALVIN VITT, St. Louis, Missouri. Dr. Smith and his co-authors have presented a very complete résumé of their experiences with aortography. This report, with few exceptions, coincides with one we* presented in 1948. I regret, though, that in retrospect the enthusiasm which I then shared does not now prevail.

Aortography is an accepted proved adjunct in the diagnosis and prognosis of certain urologic entities as well as retroperitoneal tumor and anomalies of the abdominal aorta and its branches. As a diagnostic procedure, with the exception of vascular abnormalities, it is only of significance when supplemented with the roentgenogram of the urological tract, either intravenous or retrograde, and more often is of value only when combined with a pyeloureterogram and perirenal air.

That aortography is a safe and harmless procedure can only be contested by the reported deaths. I personally regret admission of one death following injection of 80 per cent sodium iodide into the superior mesenteric artery. Death occurred in forty-eight hours due to gangrene of the bowel. Fortunately for me, autopsy showed generalized metastatic carcinomatosis. I have seen injections into the splenic, hepatic and renal arteries, the latter resulting in a relatively functionless nephrosclerosis after a four month follow-up.

* Melick, W. F., and Vitt, A. E. Present status of aortography. *J. Urol.*, 1948, *60*, 321–334.

Use of less irritating substances as 70 per cent diodrast and neo-iopax will unquestionably reduce the incidence of such undesirable effects but cannot until so proved make one of such experience feel that the information so available must at all times justify the risk. I assure you, in spite of having seen postmortem specimens of aortas that had within twenty-four hours been perforated for an aortogram with complete absence of hemorrhage or damage, I would not permit it on myself unless the knowledge so obtained was commensurate with the procedure.

I therefore feel that, in any instance in which complete urologic and roentgenographic examination is not sufficient to intelligently and honestly permit of a sound therapeutic approach, supplemental evaluation by aortography is indicated and only then when such possible supplemental information can be weighed against these possible unpleasant side effects.

DR. EVANS (closing). I wish to thank Dr. Vitt for his frank discussion of this paper. We have been aware that injection of contrast media directly into the superior mesenteric artery has caused fatalities due to mesenteric thrombosis. All 4 cases known thus far have resulted from the use of substances other than neo-iopax and diodrast; therefore, we use only these media. More important is puncture of the aorta at a high level, above the origin of the celiac axis; in other words, at the level of the twelfth thoracic vertebra.

We are continually asked about the danger of bleeding from the aorta at the puncture site. We studied the aortas of 36 patients at the time of autopsy. These patients were all moribund because of malignancy or other disease at the time of the aortic punctures which were performed four hours to twenty-four days before death. In these patients, only 6 had any evidence of blood outside the aorta and, in each, the amount was insignificant. Twelve of the 36 patients had a diastolic blood pressure of over 100 mm. Hg when the aorta was punctured.

(Slide) Before closing, I wish to project a kodachrome slide of one of the aortas punctured. You can note that there is no evidence of extra-aortic hemorrhage and the puncture wound is almost imperceptible.

We are certain that the procedure is not dangerous and does have very definite value.

Vol. 67, No. 2

ROENTGENOLOGICAL SKULL MEASUREMENTS AND THEIR DIAGNOSTIC APPLICATIONS*

By LEWIS L. HAAS, M.D.
CHICAGO, ILLINOIS

ROENTGENOLOGICAL determination of cranial size is important in differential diagnosis. When the size of the skull differs significantly from the norm, mere inspection of the roentgenogram is sufficient. When, however, the size is near to the normal limit, simple inspection may become the source of errors. By using numerical data obtained from measurements, the differentiation of doubtful and borderline cases is more definite, the description of abnormalities and pathology becomes easier and more reliable. For such comparisons roentgenological data of the normal variations should be available. The data of anthropological craniometry could be used by taking into account the enlargement by projection. However, for several reasons it is preferable to use data of actual roentgenological measurements. Of course, such figures are valid only for the target distance used. For different technique the data can be corrected by a simple computation.

In the following, roentgenological data of normal skull variation will be presented.

In a group of 170 male and 150 female white European adults the greatest length of the skull was measured. The target distance was 70 cm., the table-film distance 5 cm. The enlargement by projection, therefore, was 20 per cent.

Another group involved a series of 1,300 racially mixed patients of the University of Illinois Hospitals of various age groups and of both sexes. In this larger group the three main diameters were measured roentgenologically: the longitudinal, vertical and transverse diameters. Furthermore, the modulus and the cephalic index were computed. The target distance was 36 inches (91.4 cm.), the table-film distance 5.6 cm.; the enlargement thus was 16 per cent.

The data obtained are presented in Tables I–VI. The tables contain measurements of skulls of patients in whom no pathology was found which might have been related to the skull size, or when pathology was evident, but identical skull dimensions existed also in normal individuals. Obviously abnormal sizes were excluded. In some instances it was not possible to measure all the three diameters. The number of individuals (n) in the younger age groups was too small for statistical evaluation of σ (standard deviation) but it appeared sufficient for practical orientation. Only the adult age groups were evaluated statistically. The zone $M \pm \sigma$ corresponds generally to the range of variation of the middle sized, mesocephalic skulls. The values outside of the borderzone $M \pm 2\sigma$ are considered as suspicious for present or previous pathology in childhood. The extreme values outside the variation range $V_{min} - V_{max}$ are definitely abnormal sizes of macrocephalic and microcephalic skulls.

The *greatest length diameter* or skull length (L) was measured as the distance from the glabella to the opisthocranion, i.e., the most distant point of the occiput. Its determination is usually easy. Sometimes a marked protrusion of the frontal sinus or of the occiput (bathrocephaly) renders the evaluation more difficult, especially as both variations may occur simultaneously. Figure 1* illustrates how comparatively moderate protrusions at both ends of the length diameter add more than 1 cm. to the length. Moderate frontal protrusion is a normal

* The reproductions of most figures vary in scale due to publication requirements.

* From the Department of Radiology, University of Illinois College of Medicine, Chicago, Illinois.

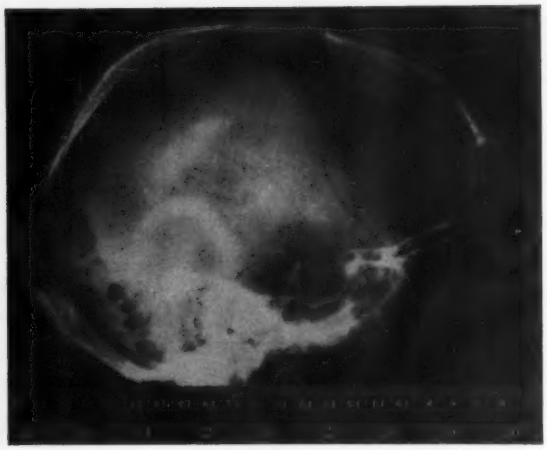

FIG. 1

TABLE I

LENGTH DIAMETER (CM.) OF ADULT WHITE EUROPEAN SKULLS ON ROENTGENOGRAMS (DISTORTION: 20 PER CENT)

	Male	Female
n	170	150
$V_{min}-V_{max}$	20.0–24.5	19.1–23.6
M	22.0	20.9
$M\pm\sigma$	21.0–22.9	20.0–21.9
$M\pm 2\sigma$	20.1–23.8	19.1–22.8

feature. It was found in 42 per cent of adult males of this series, nearly the same in the age group of eighteen to twenty years exceptionally in younger males, and in only 4 per cent of adult females.

The data pertaining to the first mentioned European group are shown in Table I, those of the second mixed series in Table II. A comparison of the data for adults in both tables reveals that the range of variation and the mean of the length of adult skulls are essentially the same in the European white and in the racially mixed American groups. Table II shows the rate of growth in the various age groups. Growth terminates in females around the fifteenth year, in males around the twentieth year. The average length in males is greater than in females in all age groups. In cases of normal skull configuration the measured length alone characterizes the size of the skull reliably. If the shape is abnormal, the other diameters must also be measured.

For measuring the skull *height* (H) anthropologists most frequently use the distance of basion to bregma. However, it has

TABLE II

LENGTH DIAMETER (CM.) OF RACIALLY MIXED SKULLS ON ROENTGENOGRAMS (DISTORTION: 16 PER CENT) OF VARIOUS AGE GROUPS OF BOTH SEXES

Age	Male			Female			Total		
	n	$V_{min}-V_{max}$	M	n	$V_{min}-V_{max}$	M	n	$V_{min}-V_{max}$	M
–4 wk.	2	13.7–14.2	13.9	3	12.6–14.0	13.2	5	12.6–14.2	13.5
2–6 mo.	8	13.5–16.2	14.7	7	13.4–14.8	14.3	15	13.4–15.0	14.5
7–12 mo.	14	14.0–17.8	16.4	12	14.5–16.9	15.8	26	14.0–17.6	16.1
13–18 mo.	12	15.8–18.2	17.1	17	15.8–18.1	17.1	29	15.8–18.2	17.1
19–30 mo.	22	16.1–19.8	18.1	12	15.7–19.5	17.7	34	15.7–19.8	17.9
3–5 yr.	40	16.4–20.4	18.9	30	16.2–20.4	18.8	70	16.2–20.4	18.8
6–8 yr.	33	17.1–20.8	19.4	29	16.0–20.7	19.0	62	16.0–20.8	19.2
9–11 yr.	34	17.9–21.1	19.6	26	16.6–21.3	19.3	60	16.6–21.3	19.5
12–14 yr.	32	18.3–21.8	20.3	26	17.9–21.0	19.7	58	17.9–21.8	20.0
15–17 yr.	34	19.0–22.2	20.6	20	18.7–21.8	20.1	54	18.7–22.2	20.4
18–20 yr.	33	19.6–22.6	20.8	29	19.2–21.0	20.1	62	19.2–22.6	20.5
21–	395	18.9–23.2	21.2	363	18.0–22.3	20.1	758	18.0–23.2	20.7
	$\sigma=-8.0+7.9$ $M\pm\sigma=20.4$–$22.0=69.8\%$ $M\pm 2\sigma=19.6$–$22.8=96.7\%$			$\sigma=-7.5+7.4$ $M\pm\sigma=19.4$–$20.9=74.5\%$ $M\pm 2\sigma=18.7$–$21.6=95.5\%$					
TOTAL	659			574			1233		

been pointed out (Martin and others) that this is not the most characteristic indicator for actual height. The topographical relation of the bregma is rather variable. It is located usually in front and below the highest point (vertex). Therefore, the total height from the basion to the vertex was measured. The basion can readily be found on adequate roentgenograms. The distortion by projection was the same as for length, because both diameters are located in the median plane of the skull. The distance from the table was not very variable. As Table IV shows, this distance, the half of the skull breadth, grows from the fifth to the eighteenth year of life roentgenologically from 75 mm. only to 81 mm. in average. The measured data are shown in Table III. There was no significant increase of height after the twelfth year in either sex.

TABLE III

HEIGHT (CM.) OF SKULL ON ROENTGENOGRAMS (ROENTGENOLOGICAL ENLARGEMENT: 16 PER CENT)

Age	Male			Female			Total		
	n	$V_{min}-V_{max}$	M	n	$V_{min}-V_{max}$	M	n	$V_{min}-V_{max}$	M
-4 wk.	2	10.2–11.2	10.7	3	9.8–13.0	11.1	5	9.8–13.0	11.0
2–6 mo.	8	10.5–13.7	11.7	7	10.8–13.5	11.8	15	10.5–13.7	11.7
7–12 mo.	10	12.1–14.3	13.3	12	11.4–13.6	12.4	22	11.4–14.3	12.8
13–18 mo.	9	12.6–15.0	14.0	17	12.1–15.5	13.6	26	12.1–15.5	13.8
19–30 mo.	22	13.6–15.7	14.7	9	13.2–15.3	14.2	31	13.2–15.7	14.5
3–5 yr.	40	13.5–16.3	14.9	26	13.5–16.0	14.6	66	13.5–16.3	14.7
6–8 yr.	33	14.2–16.7	15.2	27	13.2–16.3	14.8	60	13.2–16.7	15.1
9–11 yr.	34	14.0–17.0	15.3	25	13.8–15.8	14.8	59	13.8–17.0	15.1
12–14 yr.	32	14.4–17.0	15.6	24	13.8–16.3	15.1	56	13.8–17.0	15.4
15–17 yr.	32	14.5–17.1	15.7	19	13.8–15.7	15.0	51	13.8–17.1	15.4
18–20 yr.	29	14.0–17.4	15.6	26	13.0–16.3	15.1	55	13.0–17.4	15.4
21–	379	13.4–17.7	15.6	353	13.4–17.1	15.1	732	13.4–17.7	15.3
	$\sigma=-0.72+0.68$ $M\pm\sigma=14.9–16.3=75.7\%$ $M\pm2\sigma=14.1–16.9=95.0\%$			$\sigma=-0.64+0.64$ $M\pm\sigma=14.5–15.8=70.0\%$ $M\pm2\sigma=13.8–16.4=95.3\%$					
TOTAL	630			548			1178		

The measurement of the skull *breadth* (*Br*) technically is simple. It seemed best to measure it at the upper margin of the squamous suture, or slightly above it at the level of the stephanion, when the skull was wider here. According to anthropological data, the greatest breadth is at the upper margin of the suture in 52 per cent; in 31 per cent it is at a higher level and in 17 per cent below the suture. However, the reliability of this roentgenological measurement is limited for the following reasons. The greatest breadth usually occurs in the posterior half, in the region of the parietal eminences. In ellipsoid forms it is located in the middle, in spheroid forms in the anterior half of the skull. Furthermore, sagittal views are obtained with different angulations, dependent upon clinical purposes and individual preferences. A preliminary question is: Shall the anteroposterior or the posteroanterior views be used? Theoretically the first mentioned would be more favorable because in these views the greatest breadth is usually nearer to the film, thus the enlargement is less. In roentgenograms the breadth averages 4 to 8 mm. less on the anteroposterior as compared with the posteroanterior view. The latter view was used in this study as the great majority of the films were taken in this manner.

Table IV shows the data from these roentgenological measurements. The rate of increase in width is greatest in the first year of life. It is very slow from the sixth year. In females, growth stops earlier, at about the eighteenth year; in males, at the twentieth year.

The enlargement by projection was greater than for the other diameters because the distance of the median plane,

TABLE IV

BREADTH (CM.) OF SKULL ON ROENTGENOGRAMS (DISTORTION: 16 PER CENT)

Age	Male			Female			Total		
	n	$V_{min}-V_{max}$	M	n	$V_{min}-V_{max}$	M	n	$V_{min}-V_{max}$	M
−4 wk.	2	11.1–11.6	11.3	3	10.0–12.0	10.8	5	10.0–12.0	11.0
2–6 mo.	8	11.0–14.1	12.2	7	10.1–12.8	11.6	15	10.1–12.8	11.9
7–12 mo.	14	12.7–15.6	13.9	12	12.0–15.0	13.2	26	12.0–15.6	13.6
13–18 mo.	12	12.8–15.8	14.1	17	12.4–15.6	13.9	29	12.4–15.8	14.0
19–30 mo.	22	14.0–16.7	15.1	9	13.2–16.0	14.4	31	13.2–16.7	14.9
3–5 yr.	38	14.1–17.0	15.3	30	13.1–16.4	14.9	68	13.1–17.0	15.1
6–8 yr.	32	14.1–17.2	15.9	27	13.6–16.6	15.3	59	13.6–17.2	15.6
9–11 yr.	29	14.9–17.6	16.0	23	14.3–17.2	15.5	52	14.3–17.6	15.8
12–14 yr.	29	15.2–17.3	16.2	23	14.7–17.0	15.7	52	14.7–17.3	16.0
15–17 yr.	32	15.0–17.8	16.5	18	14.7–17.1	15.7	50	14.7–17.8	16.2
18–20 yr.	31	14.7–18.9	16.5	24	15.5–17.2	16.1	55	14.7–18.9	16.3
21–	369	14.9–19.0	16.8	356	14.2–17.9	16.2	725	14.2–19.0	16.5
	$\sigma=-0.79+0.65$ $M\pm\sigma=16.0–17.4=70.9\%$ $M\pm2\sigma=15.2–18.1=95.4\%$			$\sigma=-0.43+0.65$ $M\pm\sigma=15.4–16.8=65.7\%$ $M\pm2\sigma=14.7–17.4=96.3\%$					
TOTAL	618			549			1167		

TABLE V

MODULUS (CM.) OF SKULL ON ROENTGENOGRAMS

Age	Male			Female			Total		
	n	$V_{min}-V_{max}$	M	n	$V_{min}-V_{max}$	M	n	$V_{min}-V_{max}$	M
−4 wk.	2	11.6–12.3	12.0	3	10.8–12.8	11.6	5	10.8–12.3	11.8
2–6 mo.	8	11.9–14.6	12.9	7	12.1–14.1	12.7	15	11.9–14.6	12.8
7–12 mo.	11	13.0–15.3	14.9	12	12.9–15.0	13.8	23	12.9–15.3	14.2
13–18 mo.	9	14.3–16.1	15.3	17	13.5–16.0	14.8	26	13.5–16.1	15.0
19–30 mo.	23	14.5–16.8	15.9	12	13.6–16.6	15.1	35	13.6–16.8	15.7
3–5 yr.	33	14.8–17.4	16.3	26	14.2–17.4	16.0	59	14.2–17.4	16.2
6–8 yr.	29	15.5–17.7	16.8	27	14.3–17.5	16.3	56	14.3–17.7	16.6
9–11 yr.	30	15.7–18.1	16.9	23	15.2–17.6	16.5	53	15.2–18.1	16.7
12–14 yr.	30	16.4–18.5	17.4	23	16.0–17.6	16.7	53	16.0–18.5	17.1
15–17 yr.	32	16.6–18.8	17.6	18	15.9–17.7	16.9	50	15.9–18.8	17.3
18–20 yr.	30	16.3–19.2	17.7	22	16.3–17.8	17.1	52	16.3–19.2	17.5
21–	360	16.3–19.5	17.8	355	15.7–18.5	17.1	715	15.7–19.5	17.5
	$\sigma=-0.52+0.51$ $M\pm\sigma=17.3–18.4=72.1\%$ $M\pm2\sigma=16.8–18.9=94.2\%$			$\sigma=-0.54+0.39$ $M\pm\sigma=16.4–17.6=70.2\%$ $M\pm2\sigma=16.0–18.1=95.7\%$					
TOTAL	597			545			1142		

i.e., that of length and height to table, usually was 7 to 8 cm., while the greatest width usually was 10 to 13 cm. from the table. The distortion was less uniform, too, because of the more variable location of the greatest breadth. Regarding the variable disproportionate enlargement of breadth, it must be pointed out that these figures represent roentgenological values; they are not evenly proportional to the actual values. However, their practical diagnostic use is not diminished if the normal variation is also determined by roentgenological measurements.

The breadth being a component both of the modulus and of the cephalic index, the above consideration relates also to these. However, the *modulus* $\left(\frac{(L+H+Br)}{3}\right)$ is only slightly influenced because only one of the diameters is less exact. The roentgenological modulus is a better indicator of the size of the skull than the single diameters. In variations of shape and in deformities the opposite deviations of the single diameters may compensate each other when the modulus is computed. However, the size of normal shaped skulls is sufficiently characterized by its length alone. The computed roentgenological values of the modulus are shown in Table v. They conform to the anthropological data. The growth of the skull is fastest in the first year of life. It is rather slow from the twelfth year on and usually stops in females around the eighteenth, in males around the twenty-first year.

TABLE VI

CEPHALIC INDEX (Br×100/L) ON ROENTGENOGRAMS

Age	Male			Female			Total		
	n	$V_{min}-V_{max}$	*M*	*n*	$V_{min}-V_{max}$	*M*	*n*	$V_{min}-V_{max}$	*M*
−4 wk.	2	81.0–81.7	81.3	3	79.4–85.7	81.6	5	79.4–85.7	81.5
2–6 mo.	11	73.5–88.1	81.7	12	72.7–87.7	80.8	23	72.7–87.7	81.4
7–12 mo.	12	73.8–89.5	81.8	12	75.9–90.4	82.5	24	73.8–90.4	82.1
13–18 mo.	11	78.3–90.3	82.3	11	73.7–87.9	81.5	22	73.7–90.3	81.8
19–30 mo.	21	71.7–90.4	81.2	10	77.4–88.4	81.4	31	74.3–90.4	81.3
3–5 yr.	35	72.4–90.0	81.2	26	72.7–91.1	81.0	61	72.4–91.1	81.1
6–8 yr.	30	71.8–88.6	81.4	24	73.0–88.3	81.5	54	71.8–88.6	81.4
9–11 yr.	30	72.0–89.8	81.1	22	74.9–88.5	80.3	52	72.0–89.8	80.8
12–14 yr.	30	73.1–88.3	80.5	23	73.9–89.4	80.2	53	73.1–89.4	80.3
15–17 yr.	35	72.8–87.7	80.6	17	72.0–83.4	79.6	52	72.8–87.7	80.0
18–20 yr.	31	72.8–85.7	79.3	24	73.8–89.6	80.0	55	72.8–89.6	79.6
21–	351	71.3–89.4	79.5	354	71.0–90.4	80.0	705	71.0–90.4	79.8
	$\sigma=-3.66+3.87$ $M\pm\sigma=75.9–83.4=65.7\%$ $M\pm2\sigma=72.2–87.3=96.5\%$			$\sigma=-3.87+3.33$ $M\pm\sigma=76.1–84.2=66.2\%$ $M\pm2\sigma=72.3–88.3=94.0\%$					
TOTAL	599			538			1137		

The significance of the modulus is shown by the fact that from the 18 cases with oversized modulus of this series, in 6 cases the length was within normal limits, and in 3 cases none of the diameters exceeded the upper limit. On the other hand, there were 7 cases with increased length diameter, but not oversized modulus. In 2 of them there were congenital anomalies; furthermore, there was 1 congenital hydrocephalus, 1 acromegaly, and 1 fibrous dysplasia. For differentiation of an enlarged skull, one must consider not only the measurements, but also the other roentgenological and clinical peculiarities.

The *cephalic index* (*Br*×100/*L*) to a certain extent is characteristic of the shape

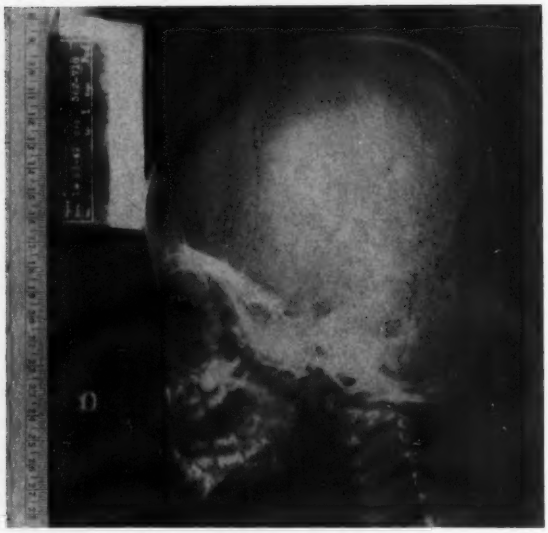

Fig. 2

of the skull. The distortion by projection of breadth is greater than that of length; therefore, the roentgenological value of the index is relatively somewhat larger than the anthropological value. The roentgenological values are shown in Table VI. During the first year of life the growth in breadth is more marked than that in length; therefore, the index is markedly increased in this period. After the first year, breadth increases less from year to year, whereas the increase in length is more significant. The cephalic index, therefore, gradually decreases with age. The decrease subsides earlier in females, the adult female remaining nearer to the juvenile form. In adults the middle zone, $M \pm \sigma$, may be regarded as the normal configuration. The skulls outside of this zone may be termed either as dolichocephalic or brachycephalic. The indices outside of the values of $M \pm 2\sigma$ are the indicators of hyperdolichocephaly and hyperbrachycephaly, respectively. The highest index of this series was 106. This concerned the skull of a ten month old boy with epileptic convulsions whose breadth was greater than the length (Fig. 2). The smallest index, 66, was obtained on an adult male skull with premature fusion of the sutures. Deformity itself does not

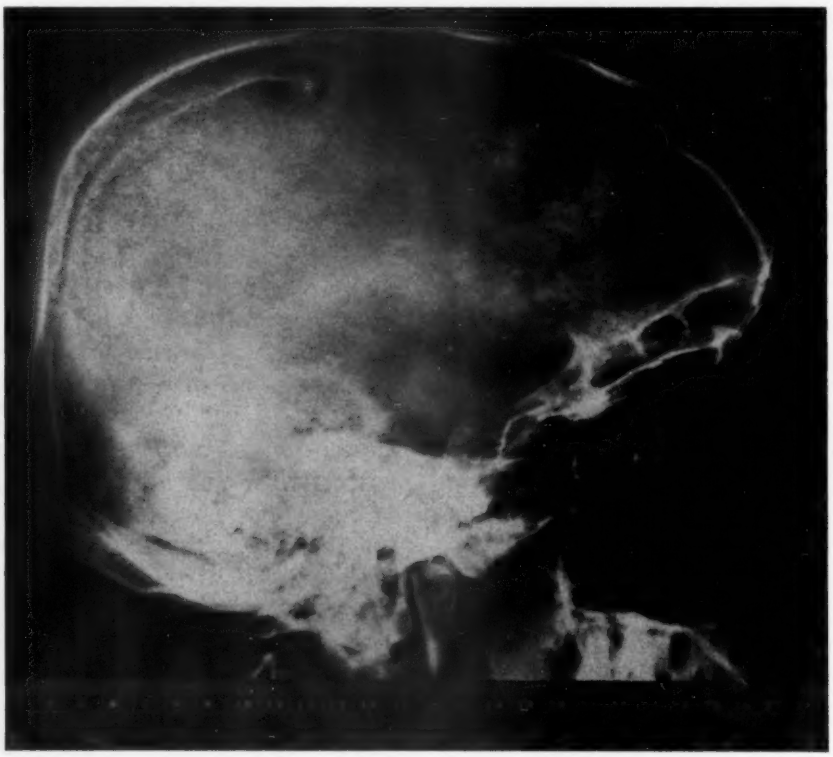

Fig. 3

necessarily mean clinical pathology without other corresponding roentgenological or clinical signs.

CONCERNING LARGE SKULLS

The cranial volume may become larger either by increase of the cranial contents or in thickness of the cranial bones. The skull increases with the growth of its contents provided the sutures remain open and sufficiently yielding to pressure. The contents of the skull, on the other hand, may increase either by growth of the brain and its

Fig. 4

parts or by increased amounts of the intracranial fluid.

The growth of the brain may be a normal or a pathological process. In the absence of pathological changes the brain exceeds the normal volume only rarely (hypertrophia cerebri). Giant skulls of this kind may be termed constitutional macrocephaly. Such a skull with a length of 176 mm. is shown in Figure 3. This twenty-three year old steel worker had no history, no somatic changes relating to the large skull. On the other hand, a skull, even though enlarged by some pathological change, may still remain within the normal limits of variation. Large and enlarged are not identical concepts. For differentiation, other roentgenological and clinical peculiarities must be considered.

Fig. 5

In the first mentioned European series a high number of larger skulls occurred associated with disturbances of the pituitary gland or with tumors of the sellar region. For the second series no relating data are available. However, the two thickest cranial bones of this series belonged to patients with acromegaly. One had an oversized skull, the other was near to the upper limit (Fig. 4 and 5). The smallest adult skull was that of a female with craniopharyngioma

Fig. 6

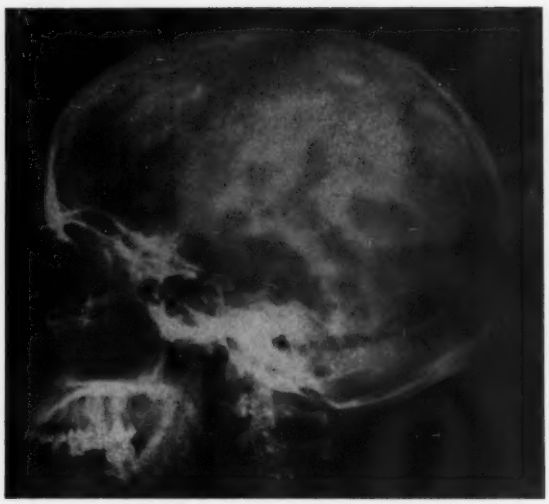

Fig. 7

Fig. 9

Fig. 8

(Fig. 6) with a modulus of 15.1 cm. Another small skull (Fig. 7) belonged to a nanosome female with pituitary hypoplasia and an exceptionally small sella turcica (surface area: 21 sq. mm.). The possibility must be considered that pituitary alterations may influence cerebral and cranial development.

Pathological increase of the cerebral substance (tumor, etc.) may lead directly to cranial enlargement, especially in the young. However, this is a rare occurrence. Sometimes it results only in local bulges.

Most tumors indirectly increase the size of the skull by producing *occlusive hydrocephalus*. A large skull showing definite

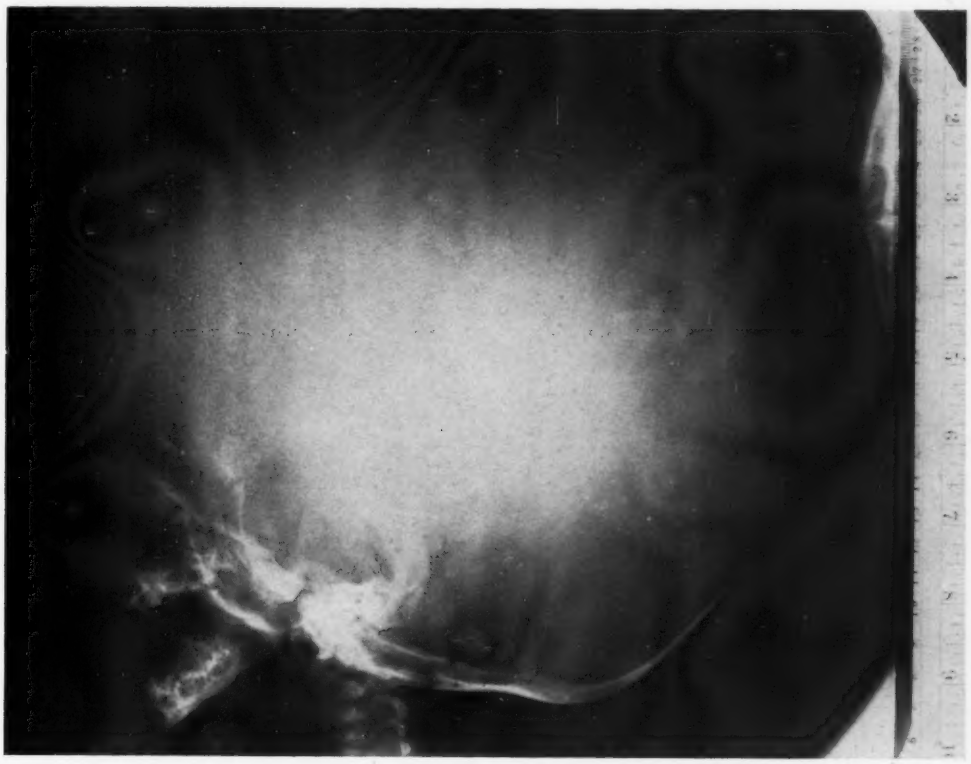

Fig. 10, *A*

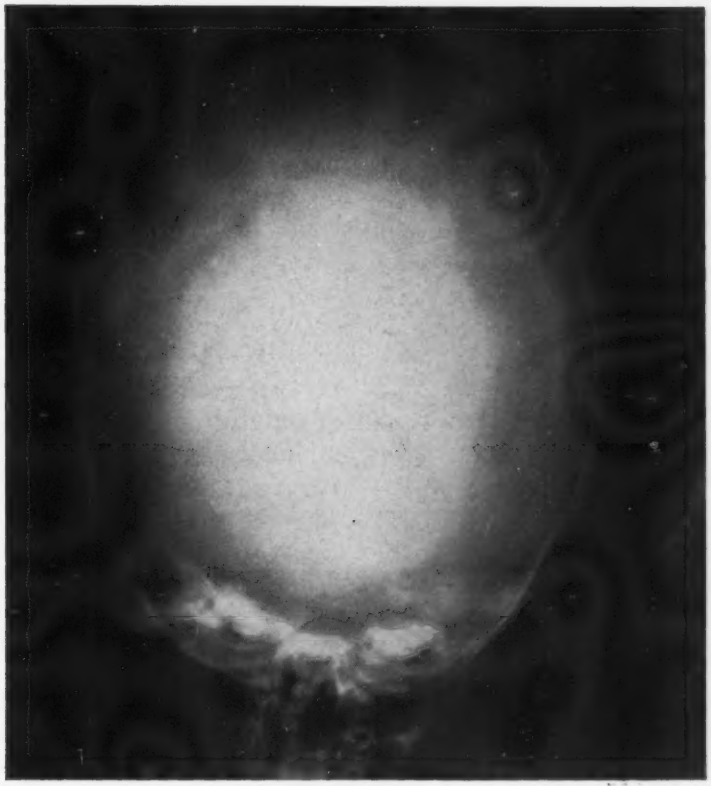

Fig. 10, *B*

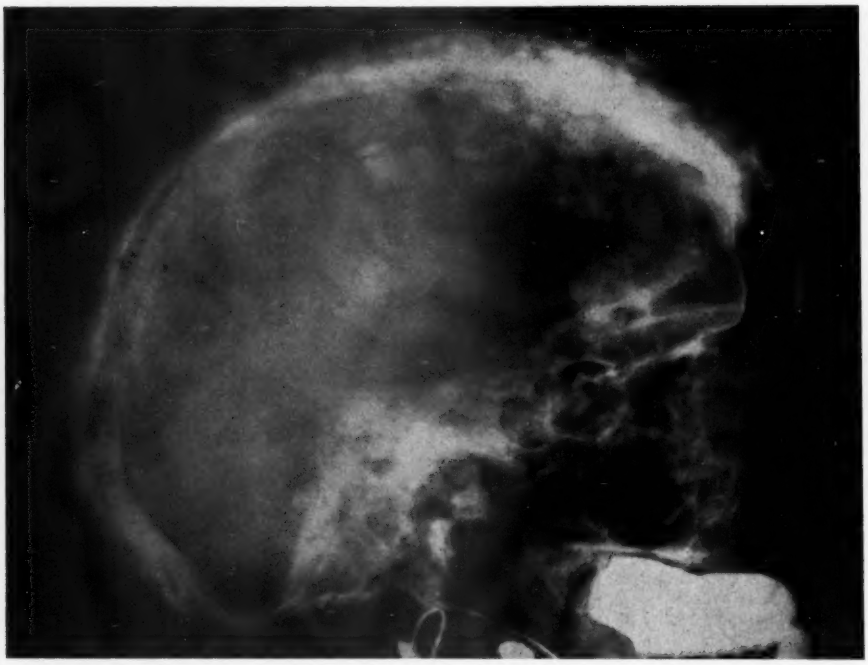

Fig. 11

signs of increased intracranial pressure is usually caused by an occlusive hydrocephalus and not by a simple hydrocephalus. Figure 8 shows the skull of a twenty-four year old male with a tumor of the fourth ventricle which produced an occlusion and a subsequent enlargement of the skull (*L*: 243 mm.). Tumors of the cerebellum and of the fourth ventricle often develop during infancy and frequently cause enlargement of the skull. Less frequent is juvenile obstruction caused by developmental abnormalities, such as basilar impression (Fig. 9), or by adhesions. Inflammatory occlusions ("pseudotumors") occur more often during adult life when the skull is no longer able to expand.

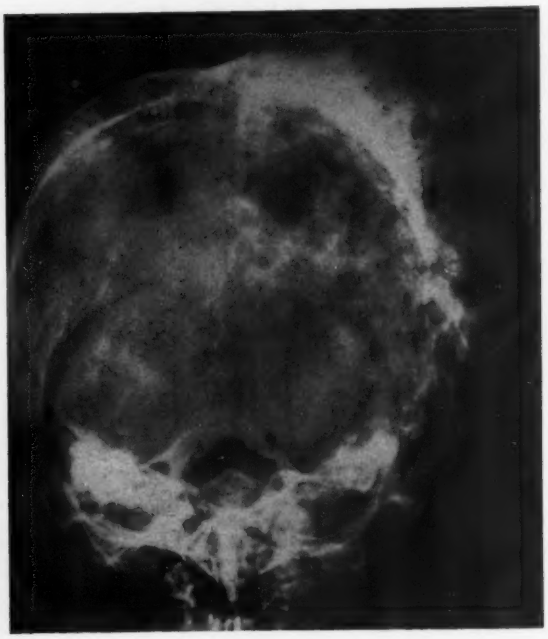

Fig. 12

Contrary to the general belief, acquired hydrocephalus simplex causes only slight or no dilatation of the ventricles and no cranial enlargement in the acute stage. Hydrocephalus of long duration, usually of congenital origin, may produce the well known large balloon skulls of infants (Fig. 10, *A* and *B*), sometimes persisting in the adolescent age.

Cranial enlargement may be caused by *increased thickness* of the cranial bones. A pathological excessive thickness may add up to 14 to 20 mm. to the length of the skull. In acromegaly the increase in length is sometimes due merely to marked bulges of the frontal sinus (Fig. 1). Osseous thickening can be most conspicuous in acro-

megaly (Fig. 4 and 5) and in various hyperplastic dysostoses, chiefly in Paget's disease (Fig. 11) and fibrous dysplasia. It may be diffuse, extending over the entire vault (Fig. 4), or partial, involving a single bone or only one side. Figure 12 shows a case of Paget's disease with sarcomatous degeneration; in some places the bones measured 27 to 30 mm. in thickness.

Thickening of the soft parts of the scalp may also suggest an enlarged head. Roentgenological differentiation is easy: the film shows an unaltered bony case and a thickened scalp which is sometimes folded

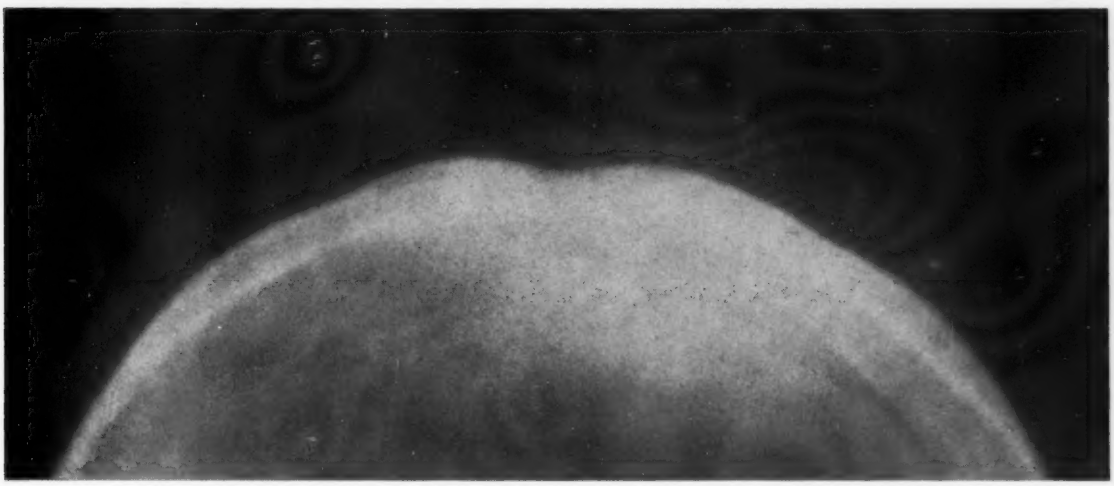

Fig. 13

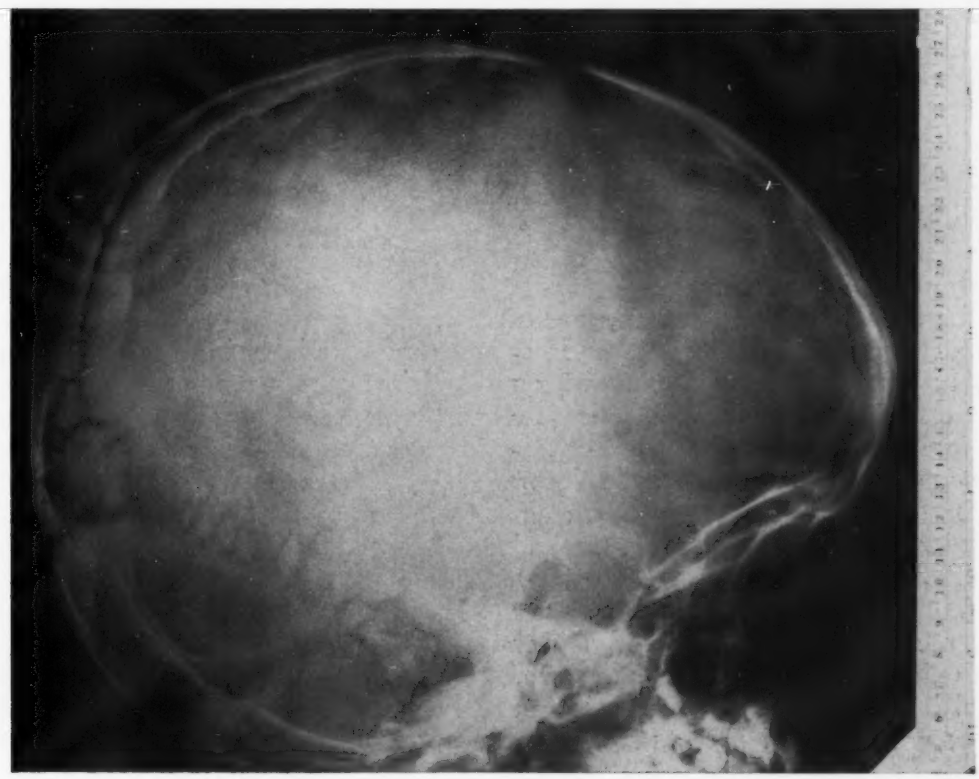

Fig. 14. *A*

FIG. 14, *B*

("cutis verticis gyrata," Fig. 13). This peculiarity occurs in acromegaly.

In the series of 1,300 skull roentgenograms of the University of Illinois Hospitals, 19 cases have been found with an oversized modulus. The largest skulls were found in 6 cases of congenital hydrocephalus. One pertained to a six and a half year old male (Fig. 14, *A* and *B*) with an unusually large modulus of 23.8 cm. (normal upper limit: 17.7) and with a length of 271 mm. (normal limit: 208 mm.). Another very large modulus was that of a four month old male (Fig. 10). It was 20.6 cm. (normal limit: 14.6) and the skull length was 245 mm. (normal limit: 162). Other causes for oversized skulls were: congenital abnormalities, such as platybasia with Klippel-Feil syndrome or with osteogenesis imperfecta, and congenital or birth injuries in 7 cases (Fig. 9); furthermore, tumor of the posterior fossa in 2 cases, single cases of acromegaly, rickets, and pituitary disturbance. One large skull showed no clinical symptoms.

CONCERNING SMALL SKULLS

Any pathologic condition causing retardation of development may be the cause of a small skull size. The retardation may be temporary or permanent—temporary if after healing of the disease, the growth can be compensated, and permanent if restitution is not possible. In the series presented here there were 14 cases with subnormal modulus. All showed some pathology caus-

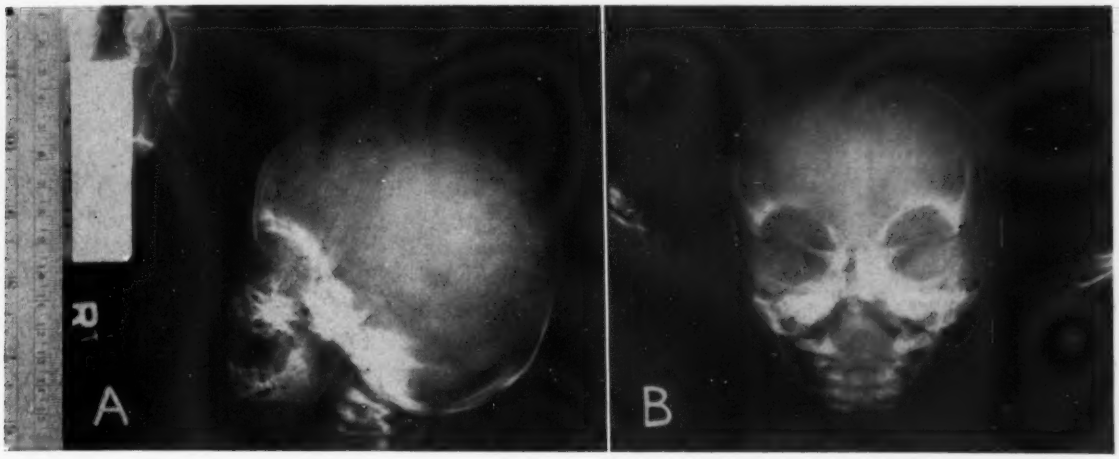

Fig. 15, *A* and *B*

ing the retardation: congenital abnormalities (such as meningocele, etc.), congenital and birth injuries of the brain (cerebral agenesis), nanosomia of pituitary or other origin, and craniopharyngioma. One adult female (modulus: 15.3) had an adenoma of the pancreas without any evidence of constitutional aberrations. The relatively smallest modulus belonged to an eleven week old female with progeria (8.2 cm., normal lower limit 10.8) and to a two month old male with multiple congenital anomalies (10.6 cm., normal limit 11.9) (Fig. 15). Two of the smallest adult skulls have been mentioned earlier (Fig. 6 and 7). There was no case of undersized skull in the 12 cases of the series with premature fusion of the sutures, though in 2 cases the modulus was close to the normal lower limit.

It is evident that skull size and measurements have diagnostic value. Yet the significance of quantitative deviations should not be overestimated. If present, such deviations of size call for detailed clinical and roentgenological studies.

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PERIGASTRIC ADHESIONS AND BANDS INVOLVING THE PYLORIC ANTRUM

A DIAGNOSTIC ENIGMA*

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THE correct preoperative diagnosis of pyloric lesions is often impossible. There are fallibilities in all known diagnostic methods, where such lesions are concerned. Both from a clinical and roentgenologic standpoint, the differentiation of intraluminal gastric tumors, far-advanced infiltrates and benign ulcerations, is more readily accomplished. Roentgen diagnosis of such conditions has been well established, and need not be considered in this discussion of prepyloric lesions. At this time, the discussion will be confined to prepyloric deformities due to adhesions and bands, roentgenologically compatible with deformities produced by malignant gastric pathology.

Very little has been written regarding this subject in spite of its importance and relatively frequent occurrence. Much attention, however, has been focused on the obstructing effect upon the duodenum by congenital bands and adhesions. As early as 1914, Harris[2] described roentgenographic deformities of the duodenum resulting from anomalous congenital bands. These he thought to be remains of the anterior mesogastrium resulting from faulty embryonic development. The ligamentous folds exerted pressure upon the first and second parts of the duodenum as they crossed it in their attachment to the hepatic portal. The pyloric antrum was not involved by such pressure, but dilatation of this portion of the stomach was a prominent feature. Taylor[6] in 1922 reported numerous cases in which he had operated for symptoms arising from anomalous abdominal membranes. These he felt had developed during fetal life from atypical peritoneal fusion; many probably modified by later pathological changes resulting from continued traction or low grade inflammation. Symptoms of partial obstruction, together with digestive disturbances, general nutritional disturbances and nervous debility, often accompanied epigastric tenderness. When an abnormal hepatoduodenal membrane was present, roentgenologic findings showed high fixation of the duodenal bulb with occasional deformity resembling an ulcer. Likewise, dilatation and surging of the second and third parts of the duodenum accompanied the presence of a duodenojejunal membrane. No mention is made of the pyloric or prepyloric deformity.

In reporting the findings of 7 cases of perigastric adhesions, the discussion has been limited to adhesions and bands deforming the pyloric antrum, that is the distal 2.5 cm. of the stomach, adjacent to the pyloric sphincter. It is here that benign gastric deformities may closely resemble intramural gastric malignancy. The authors[3] have previously reported benign spasm showing such characteristics.

Since both congenital anomalies and inflammatory adhesions are involved, the pathology is dependent upon developmental as well as adult anatomical relationships. According to Arey,[1] the gut arises when the entoderm is folded into a tube. At the same time, lateral splanchnic mesoderm swings inward from each side towards the midplane and forms a double-layered sheet, extending from the roof of the celom to the mid-ventral body wall, thus contain-

* Presented at the Fifty-first Annual Meeting, American Roentgen Ray Society, St. Louis, Mo., Sept. 26–29, 1950.

ing the gut between its layers. This membrane is the primitive mesentery. The portion of the digestive canal which passes through the peritoneal cavity is contained in an originally continuous dorsal mesentery. Later distinctive names are given to the several regions. Thus, there is the dorsal mesogastrium (greater omentum) of the stomach, the mesoduodenum, the mesentery of the small bowel, and the mesocolon. The history of the mesogastrium is concerned with the development of the lesser peritoneal sac. The liver grows out into the ventral mesentery from the fore-gut, and is thus enclosed by the lamella of the ventral mesogastrium. As the liver increases in size, this gives rise to the capsule and ligaments. The portion of the mesentery between the liver, stomach, and duodenum is the lesser omentum. This, in the adult, is differentiated into the hepatogastric and hepatoduodenal ligaments. The mesogastric attachment of the liver to the ventral body wall extends caudally from the diaphragm to the umbilicus, and constitutes the falciform ligament. In the adult this is a broad and thin peritoneal fold, which in its anteroposterior plane, passes upward and backward from its attachment behind the right rectus, often as low as the umbilicus. It passes upward to the diaphragm and backward to the left lobe of the liver. Between its layers it contains the parumbilical veins and the round ligament.

The pathology in the following case was undoubtedly developmental. An adhesive band which was continuous with the lower border of the liver and the falciform ligament was found surrounding the pyloric end of the stomach, about 1 inch proximal to the pyloric sphincter, producing a funnel-shaped narrowing of the pyloric antrum. This was first discovered during roentgenographic examination and thought to be due to malignancy (Fig. 1 and 2). The band at operation shelled off the anterior wall of the stomach after division, revealing a normal stomach beneath. Nothing suggestive of malignancy was found. As was to be expected, the roentgen characteristics were similar to an intramural malignancy, as the narrowing was constant at several examinations and could not be affected by antispasmodics. The relatively rigid encirclement of the gastric wall inhibited the passage of pyloric waves, and distorted the gastric rugae.

Briefly reviewing the normal anatomy of

Fig. 1. Pressure by falciform ligament.

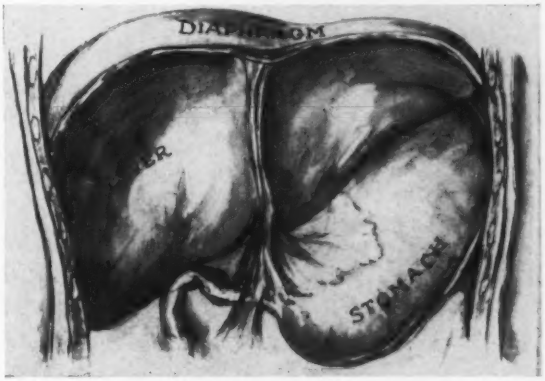

Fig. 2. Drawing showing pressure by falciform ligament.

the gastric attachments, one recalls that the pyloric antrum on its lesser curvature is covered by peritoneum giving rise to the two layers of gastrohepatic omentum. Its two components, the gastrohepatic and duodenohepatic ligaments, pass upward to attach about the hepatic portal. The right lateral margin is reflected around the hepatic artery, bile ducts, and portal vein, turning backward, to form a free folded edge of the peritoneum. As it winds about

the portal vessels, it becomes the anterior boundary of the foramen of Winslow. On the greater curvature, through reflection of the peritoneum around the pylorus, it forms the attachment of two layers of the greater omentum, which forms the gastrocolic ligament uniting the stomach and transverse colon. Normally, these gastric ligaments allow the stomach considerable mobility, and interfere in no way with the passage of peristaltic waves over the

FIG. 3. Traction on lesser curvature due to short gastrohepatic ligament.

gastric walls. Roentgenoscopically, the prepyloric portion of the stomach and duodenum is relatively more fixed than the pars media but, even so, may be moved several centimeters by the palpating hand. Fixation of the stomach is highly suggestive of extragastric pathology, but when this is associated with a filling defect deforming either curvature, extension of gastric pathology into the surrounding tissues is highly probable. Such a finding, together with rugal disturbances and inhibition of peristaltic waves, caused surgical exploration of another case. The free edge of the lesser omentum was found to be thickened and short. Included in this was a heavy band, presumably the gastrohepatic ligament. This was attached to the lesser curvature of the stomach, approximately 2 cm. from the pyloric sphincter, fixing and elevating this portion of the stomach and angulating it in such a manner as to depress the lesser curvature distal to its attachment. This accounted for the filling defect in the prepyloric region (Fig. 3 and 4). Inspection of the gastric mucosa, as well as palpation, revealed it to be normal.

In 2 similar cases, roentgen examination and subsequent rechecks after atropine showed an upward displacement of the

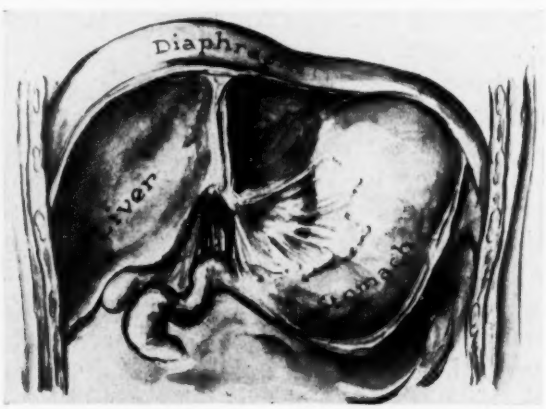

FIG. 4. Drawing showing traction on lesser curvature due to short gastrohepatic ligament.

greater curvature of the stomach near the pyloric antrum. The pyloric antrum was constantly narrowed, but the lesser curvature appeared normal. The rugae were flattened and irregular. There was some puckering of the margin along the greater curvature (Fig. 5 and 6). Subsequent surgical exploration revealed an adhesion between the greater omentum and the pylorus, displacing the greater curvature. The stomach was freely movable; there were no indurations and no evidence of pathology in the gastric area or colon to account for the adhesion. The mucosa was normal except for a scar at the point of adherence of the greater omentum.

The constant close relationship of the gallbladder to the duodenal bulb and pylorus further complicates pyloric pathology. In 2 instances patients were found to have definitely irregular, narrowed, fixed and rigid pyloric antrums. Both curvatures

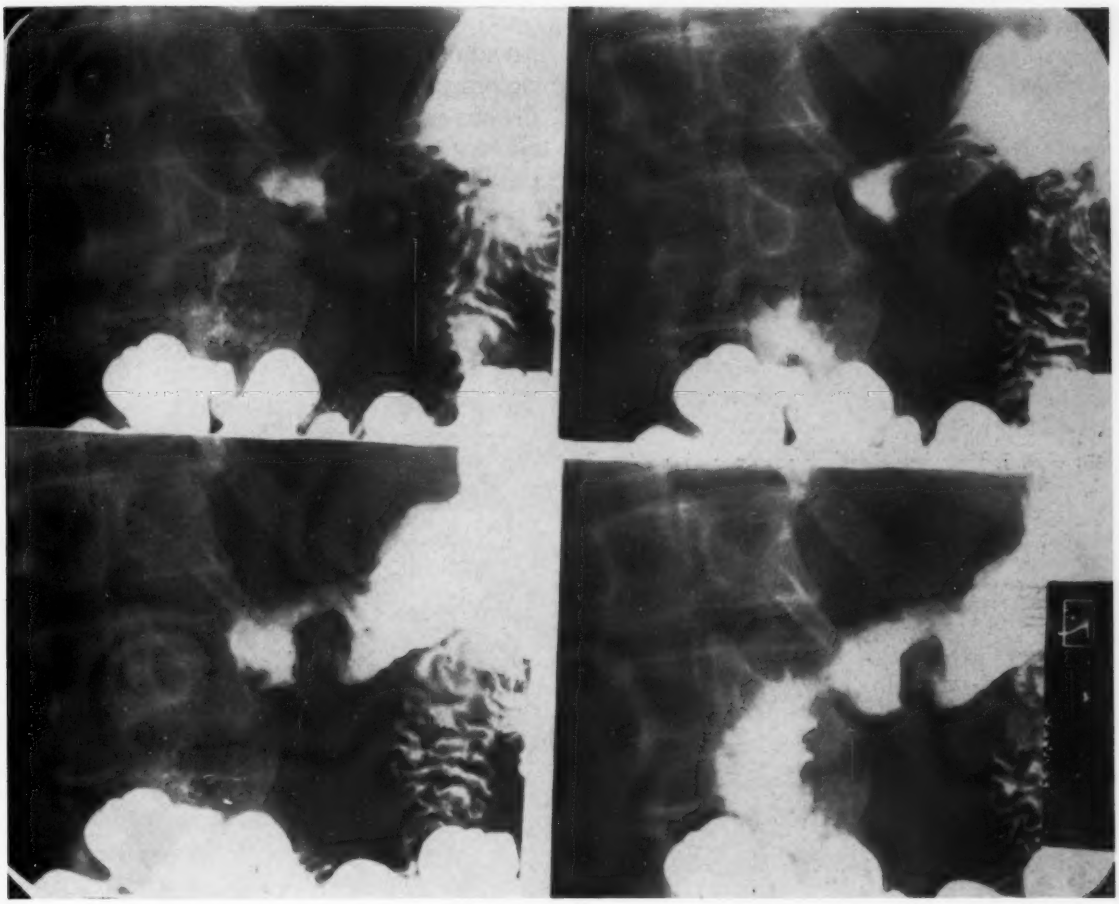

Fig. 5. Adhesion to omentum and stomach.

Fig. 6. Drawing showing adhesion of omentum to lesser curvature of the stomach.

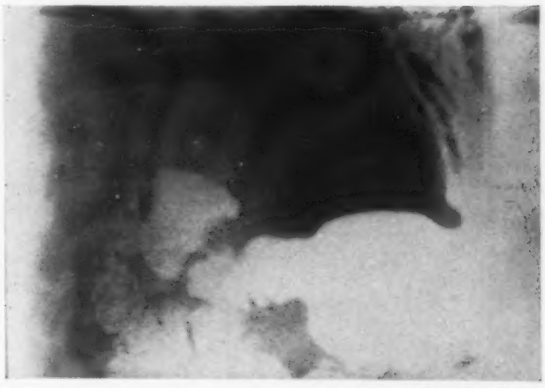

Fig. 7. Pyloric deformity as result of gallbladder adhesions.

were involved. The peristaltic waves ended abruptly at the area of narrowing. The lumen in each measured less than 1 cm. in diameter, and the rugae could not be outlined in one (Fig. 7), while the other showed irregularity of the rugae (Fig. 8). Roentgen examination of the colon was negative and the gallbladder had previ-

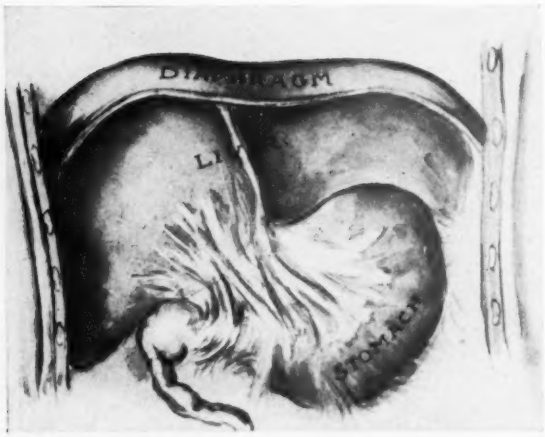

FIG. 8. Drawing showing postoperative adhesions about gallbladder site.

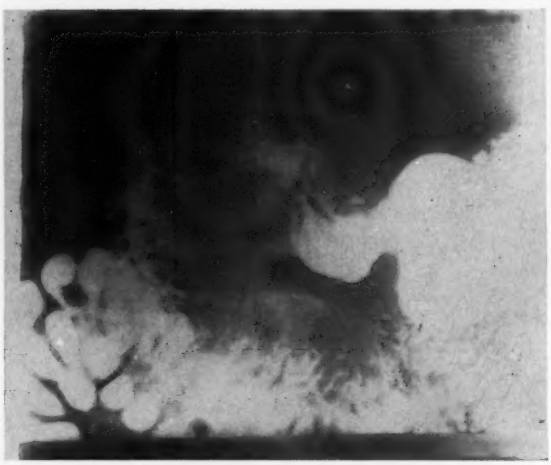

FIG. 9. Ulcer before fibrosis.

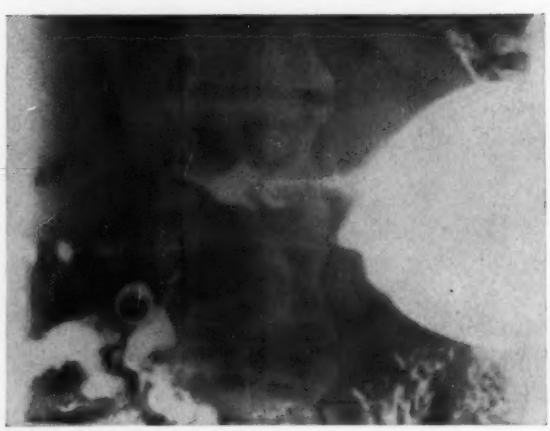

FIG. 10. Duodenal ulcer (seventeen months later); perigastric fibrosis.

ously been removed in each case. In these instances the surgeon found the entire right upper quadrant obliterated by dense fibrous adhesions, extending like a partition from the old gallbladder scar to the posterior abdominal wall, contracting and absolutely fixing the pyloric end of the stomach in position. After extensive dissection, the pyloric end of the stomach and the first part of the duodenum were freed from the adhesions. Nothing could be felt

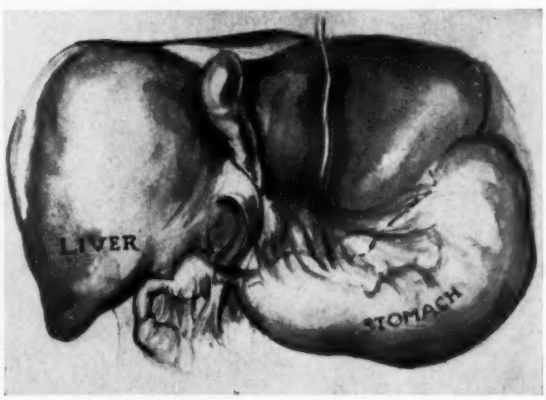

FIG. 11. Drawing showing fibrosis from ulcer in duodenum.

in the nature of an induration or malignant nodule. The stomach was incised and no intramural lesion could be found through the incision.

As has been stated, adhesions may also arise from pathology within the stomach. This is very important in view of the fact that certain benign lesions may become malignant. In 1937, a patient was examined in the roentgen department and was found to have a small ulcer at the base of the duodenal bulb (Fig. 9). Several years later, the same patient was found to have developed a narrowed irregular pyloric antrum with inhibition of peristaltic waves and rugal disturbances. At operation, the patient was found to have developed a marked fibrosis surrounding the pylorus, originating at the old ulcer site, and thereby deforming the prepyloric area (Fig. 10 and 11). There were no nodules. Liver and gallbladder were normal and no indication of malignancy or metastasis was found. A

posterior gastroenterostomy was done.

It is interesting to note that all 7 patients presented were over fifty years of age (except one female who was seventy-eight years of age). When one understands the developmental anatomy and gross anatomic relationships about the stomach, the origin of such perigastric adhesions or bands is quite clear. However, the fact that these patients developed symptoms so late in life is another matter. As has been stated, continued traction, low grade inflammation, and changes in the habitus of the patient may be a contributing factor.

In all instances there were complaints of vague epigastric distress and weakness. Two patients complained of pressure and fullness about the heart. In 5 patients, nervousness and irritability were prominent factors. All suffered from distress after meals, but only one had a history of vomiting. Weight loss was a variable factor. All such symptoms have been described before, and appear to arise chiefly from the strong peristaltic action necessary to force food past the point of obstruction.

Of greatest importance, from a clinical standpoint, is the fact that every one of the 7 patients had signs of gastrointestinal bleeding and all but two had achlorhydria. Only one patient had any known pathology to account for the bleeding; the one known case of duodenal ulcer. Two other patients had tarry stools and all had a 4 plus benzidine reaction on a meat, gravy and iron-free diet. In all cases a barium enema had been done which was negative in each instance. Four of the 7 cases had no free or combined acid. One had the maximum of 40° combined acid and one failed to have a gastric analysis. In connection with the findings of bleeding, Sahler and Hampton[5] have reported bleeding as the most common, constant symptom in extramucosal tumors of the stomach. They account for the bleeding by thinning of the mucosa and small ulcerations. No mucosal ulcerations were found at surgery in any of the 7 cases just presented.

Gastroscopic examinations were done on 2 patients. One was reported negative, and that of the other patient, with the defect due to the falciform ligament, was reported as follows:

> The patient was very cooperative and the examination perfect. The pylorus immediately came into view and it was evident from the first that there was pathology present. The pyloric canal was entirely rigid and its surrounding showed definite protrusion into the cavity of the stomach. Peristaltic waves developed in the antrum and moved energetically toward the pylorus, but they flattened out when they touched the stiffened portion. The antrum mucosa showed patches of adherent mucus and the lower body wall showed thinning of the mucosa.

CONCLUSIONS

1. Lesions of the pyloric antrum are of equal interest to the diagnostician and surgeon.

2. Close cooperation is essential to identify such lesions early. This depends upon early recognition of suggestive symptoms and an early diagnostic study.

3. Should the conclusion leave any doubt as to the presence of a malignant or a potentially malignant lesion, surgery is advisable.

4. Prepyloric defects that persist after the administration of antispasmodic and medical management should be subjected to surgery.

5. To find no lesion at operation in the presence of a persistent roentgenological defect is definitely better than at a later date to find an inoperable malignancy.

6. The mortality from a simple exploratory operation is very low and to miss or overlook a carcinoma is too high a price to pay.

7. Persistent roentgenological defects do occasionally occur in the absence of surgical proof.

8. In the light of our present knowledge, it is often impossible to differentiate, clinically or roentgenologically, pyloric defects. Unfortunately, gastroscopic examination does not clarify the diagnosis.

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Vol. 67, No. 2

CLINICAL STUDIES ON THE USE OF CONTROLLED INTRAGASTRIC PRESSURE FOR THE ROENTGEN DIAGNOSIS OF LESIONS IN AND ABOUT THE FUNDUS OF THE STOMACH*

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APPROXIMATELY 5 per cent of all gastric tumors are found in the upper half of the stomach. Fifty per cent of the sarcomas reported by Marvin and Waters[32] were found in this area of the stomach.

With the growing ability of surgeons to resect this portion of the stomach, it has become increasingly important for radiologists to make a more definite diagnosis of lesions in this area.

Even with the most superficial review of the history of roentgenological diagnosis of lesions of the stomach, it is readily apparent that those portions of the stomach that are not easily available to palpation have offered radiologists considerable difficulty in diagnosis. This is repeatedly borne out in articles written on the subject. One of the more recent articles is by Sherman,[42] in which he says, "The greatest contribution of gastric roentgenology lies in the ability to detect organic abnormalities. Potentially any lesion of macroscopic size which does not exhibit a physiological feature as its sole characteristic can be uncovered." He continues, "The most important procedural handicap in the roentgen examination of the upper stomach is its inaccessibility to palpation."

We know from personal experience that it is not too difficult to make a diagnosis or at least detect the presence of even quite small lesions in the lower portion of the stomach, that is, those areas accessible to palpation and compression spot films. Our ability to study the elasticity, the mobility, and the motility of that part of the gastric wall makes this relatively easy. In the first part of the duodenum we pride ourselves on our ability to see very small ulcerations, again due primarily to its accessibility to palpation.

To date, only a few concerted efforts have been directed toward the improvement of roentgenological methods of examination of the upper half of the stomach.

Since the year that Röntgen published his first report on roentgen rays, a means of improvement has been available which we have found to be of considerable help in the detection of abnormalities in the upper half of the stomach. In 1895, Moritz of Munich was apparently the first to introduce a balloon into the human stomach. He was a physiologist and was interested in studying intragastric pressures. Following this, numerous physiologists have introduced balloons into both the human stomach and those of experimental animals.

Following 1941, when D'Eloia[10] described a method of inflation of a balloon in the stomach, several investigators have reported the use of a balloon with barium in the stomach. Among them, Gruber[18] and Le Canuet, Lapipe, and Prichard[26] described essentially the same method. To

TABLE I

RESULTS OF BALLOON EXAMINATIONS 1947–1950

	Negative Findings	Pathology Found	Total Examinations
No. of cases	38	16	54
Per cent	70.3	29.7	100

* From the Department of Radiology, University of Louisville School of Medicine. Illustrations by the Department of Visual Education, University of Louisville School of Medicine.

TABLE II

Case No.	Hospital No.	Age, Sex, Color	Clinical Impression before Roentgen Study	Roentgen Impression before Balloon Study	Roentgen Impression after Balloon Study	Operative Findings	Pathological Report
1	178766	27 M W	Bleeding peptic ulcer	Diffuse infiltration of entire stomach with polypoid lesions of the mucosa: sarcoma, lymphoma or polypoid carcinoma	Polypoid lesions of almost entire stomach mucosa with infiltration of the wall. Impression the same	None; patient died	Polyps with adenocarcinomatous degeneration
2	187700	70 M C	Carcinoma of stomach	Filling defects of greater and lesser curvatures of antrum: probable carcinoma.	Marked loss of elasticity throughout involved area. Carcinoma	Baseball-sized mass within lumen of the stomach involving both curvatures in distal third	Adenocarcinoma of stomach with regional lymph node metastases
3	178093	26 M C	Multiple neurofibromatosis. Tumor of stomach—probably neurofibrosarcoma	Marked narrowing of prepyloric area with stomach displaced anteriorly	Balloon study ruled out the possibility of an intrinsic mass. Impression: extrinsic tumor compressing stomach	Large tumor mass about 40×35×15 cm. arising below lesser sac	Retroperitoneal neurofibrosarcoma with regional lymph node metastases
4	158434	38 M W	Bleeding peptic ulcer	Gastrojejunostomy with irregularity at distal end of stomach involving greater curvature: possible neoplasm	Loss of "profile line" along lower third of lesser curvature, consistent with carcinoma of stomach	Gastrojejunostomy (done for "ulcer" elsewhere); carcinoma involving lesser curvature and extending to esophagus	Adenocarcinoma of stomach with metastases to regional lymph nodes
5	170326	58 M W	Possible carcinoma of stomach	Large filling defects along greater curvature in middle and lower thirds of body: polypoid carcinoma	Same	Five polyps found along greater curvature, measuring up to 3×3 cm. No nodes found. Subtotal gastrectomy performed	Adenocarinoma of stomach; no invasion of stomach wall, or of regional lymph nodes
6	178945	40 F C	Mass in left upper quadrant; incidental finding in patient with diabetic coma	Mid-portion of stomach displaced anteriorly by mass; indefinite as to whether mass intrinsic to stomach or extrinsic	Stomach displaced and compressed by mass definitely extrinsic	Cystic mass arising in lesser sac, firmly adherent to surrounding structures, contains 1,000 cc. fluid	Cyst wall formed of connective tissue with no epithelial lining: Pseudocyst of the pancreas
7	151524-	56 M C	Abdominal distention, etiology unknown. Possible carcinoma of the stomach	Large filling defect of the greater curvature of the stomach	No intrinsic lesion of the stomach. Filling defect due to extrinsic mass	Clinical diagnosis of perisplenitis; patient discharged	Needled perisplenic region with blood aspirated
8	91541	30 M C	Carcinoma of the stomach with metastases to the liver	Irregularity of fundus of stomach, suggestive of carcinoma	Definite intrinsic lesion of the fundus, probably carcinoma	Stomach densely adherent to surrounding structures. Large, ulcerated, cauliflower type lesion: Carcinoma of fundus	Adenocarcinoma of fundus of stomach

Case No.	Hospital No.	Age, Sex, Color	Clinical Impression before Roentgen Study	Roentgen Impression before Balloon Study	Roentgen Impression after Balloon Study	Operative Findings	Pathological Report
9	4001	29 M W	Possible peptic ulcer	Defect in fundus of the stomach extending along both curvatures	Irregularity in cardiac end of stomach consistent with malignancy	Stomach wall in region of cardia thickened and nodular. Subtotal gastric resection performed	Enormous hypertrophy of gastric mucosa in region of fundus, up to 1 cm. thick. Microscopic: Reticulum cell sarcoma
10	109728	65 M W	Marginal ulcer at site of previous gastroenterostomy stoma	Barium does not fill the stomach distal to the gastroenterostomy, making visualization of the prepyloric area difficult	Filling defect in prepyloric region demonstrated by the balloon	Tumor of the stomach adherent to liver, colon and pancreas. The posterior gastroenterostomy was invaded by the tumor	Diffuse carcinoma of the stomach invading the stomach wall
11	196507	61 F W	Subacute intestinal obstruction	Carcinoma of greater curvature	Same	Extensive carcinomatosis with peritoneal implants; 2,000 cc. ascitic fluid	Ascitic fluid showed cancer cells; no tissue biopsy examination
12	154880	57 M W	Possible tumor of colon or stomach	Suggestion of polyps in prepyloric area	Polyposis of the stomach	Extensive carcinoma of stomach, extending into the colon	Colloid carcinoma of the stomach
13	159682	65 M C	Malignant tumor of the stomach	Carcinoma of the prepyloric area	Same	Annular carcinoma of prepyloric area	Adenocarcinoma of the stomach
14	165118	73 F W	Pyloric obstruction	Carcinoma of body of stomach	Same	Carcinoma of body of stomach	Carcinoma of the stomach with metastases to regional lymph nodes
15	45354	45 M C	Hypertension. Easy fatigability. "Large functional element"	Possible hypertrophic gastritis; possible polyposis. Retrogastric mass, probably aneurysm	Ulcer lesser curvature with malignant change? Probable aortic aneurysm	Tumor mass displacing stomach anteriorly and filling lesser sac, but arises retroperitoneally. Fixed to surrounding structures, including aorta	Retroperitoneal colloid carcinoma with intraperitoneal implants. (Of duct origin?)
16	148279	69 M W	Unexplained anemia	Round, circumscribed filling defect, proximal third of the stomach, mucosa intact over it, probably benign	Carcinoma of the fundus of the stomach	9×7×5 cm. fixed tumor mass infiltrating the posterior wall of the stomach at the fundus	Neurofibrosarcoma

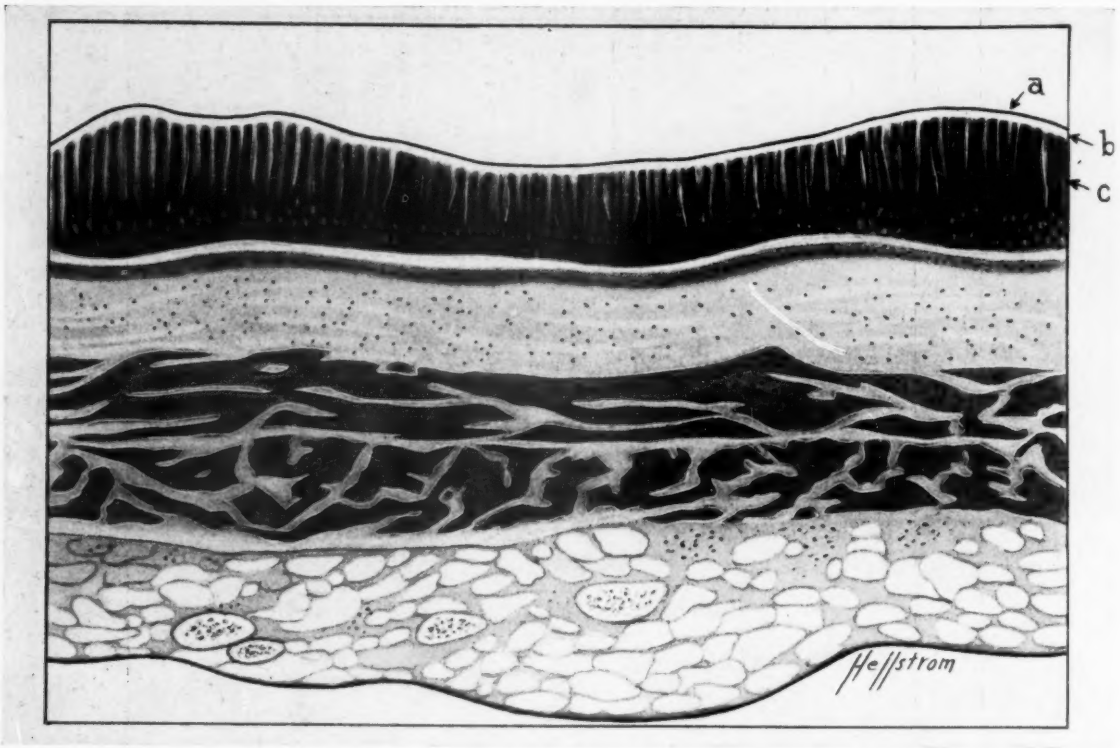

FIG. 1. Schematic drawing of a cross-section of stomach wall showing (*a*) the rubber balloon, (*b*) thin layer of barium, (*c*) gastric mucosa, in an attempt to show the approximate conditions that obtain to produce the so-called "profile line," which is seen over normal mucosa when the thin layer of barium is trapped between the balloon and the gastric mucosa.

date, we have not found any indication that these workers have attempted to establish definite diagnostic criteria for lesions in and about the fundus of the stomach.

Our particular method was originally described in 1949,[35] and it will not be repeated here. With it, during the roentgenoscopic procedure it is possible to study the elasticity, mobility and motility of the portions of the stomach not normally accessible to palpation. Films may be made in various positions with the barium always in the more dependent portion of the stomach and the balloon in whatever might be the superior portion of the stomach in the given position.

With our most recent cases we have routinely made stereoscopic films of the balloon-distended stomach in both the right anterior oblique and the left posterior oblique positions. These have resulted in excellent visualization of the upper half of the stomach, which is much better than that seen by any other means.

We have now used the method in 54 cases of suspected pathology of the stomach. Sixteen of these patients examined have shown proved pathology in or about the fundus of the stomach (Table 1). To date, in the proved cases we have been very fortunate in that we have been able to differentiate between intrinsic and extrinsic lesions. This has been done by study-

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FIG. 3. Case 9. (*A*) Right anterior oblique film, showing some indentations about the fundus of the stomach, the exact significance of which was not known at the time of the original examination. (*B*) Right anterior oblique film of the same case with a balloon in place, showing the marked irregularity both above and below the esophageal hiatus, with an absence of the smooth "profile line" in both positions.

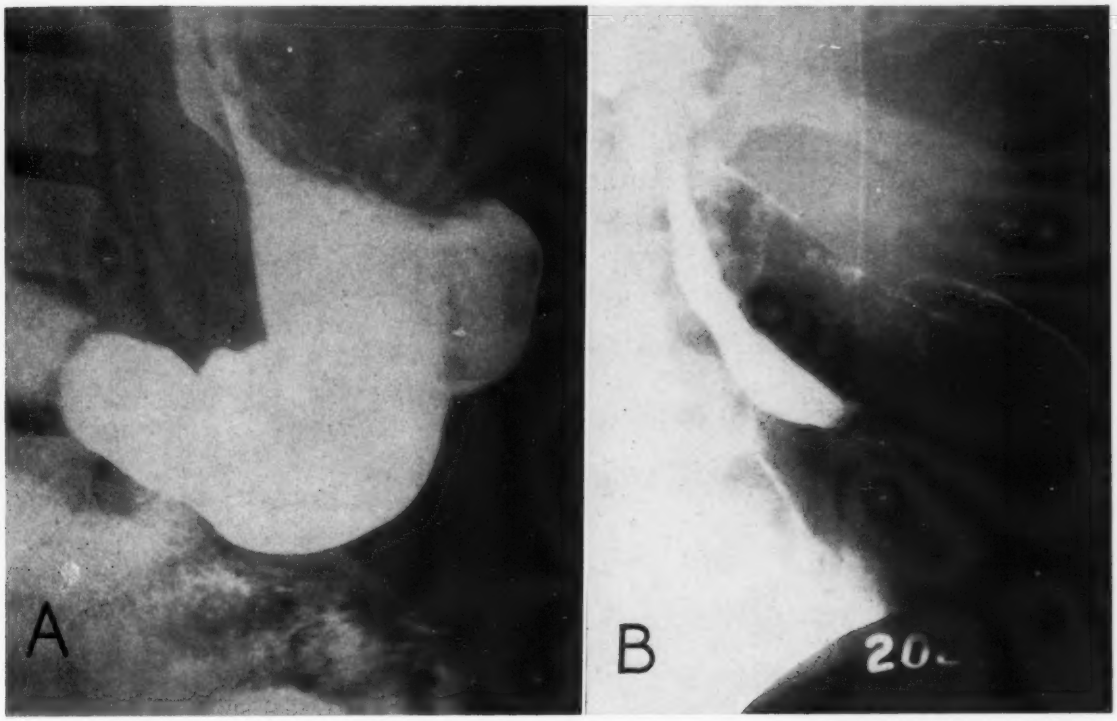
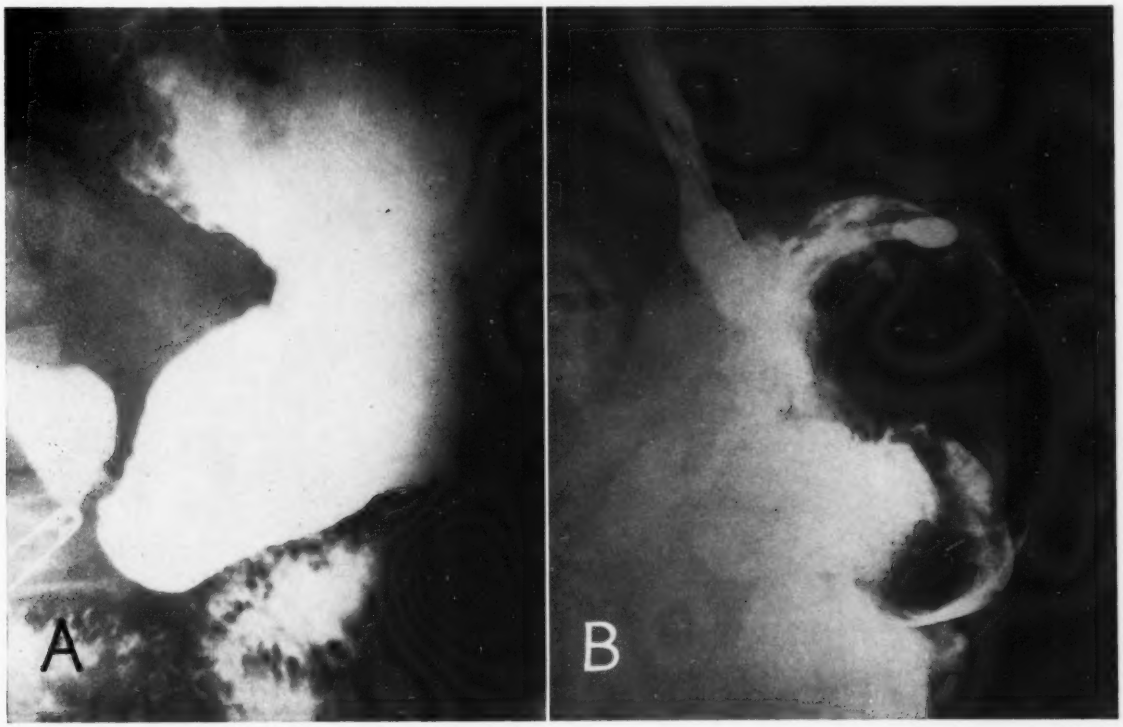


Fig. 2. Case 7. (*A*) Right anterior oblique film of a barium-filled stomach, showing the marked depression of the fundus by a large extrinsic mass. (*B*) Spot film made during roentgenoscopy of the same stomach, with a balloon in place showing a normal thin "profile line" adjacent to the large extrinsic mass, indicating that the mucosa itself of the stomach is not involved.



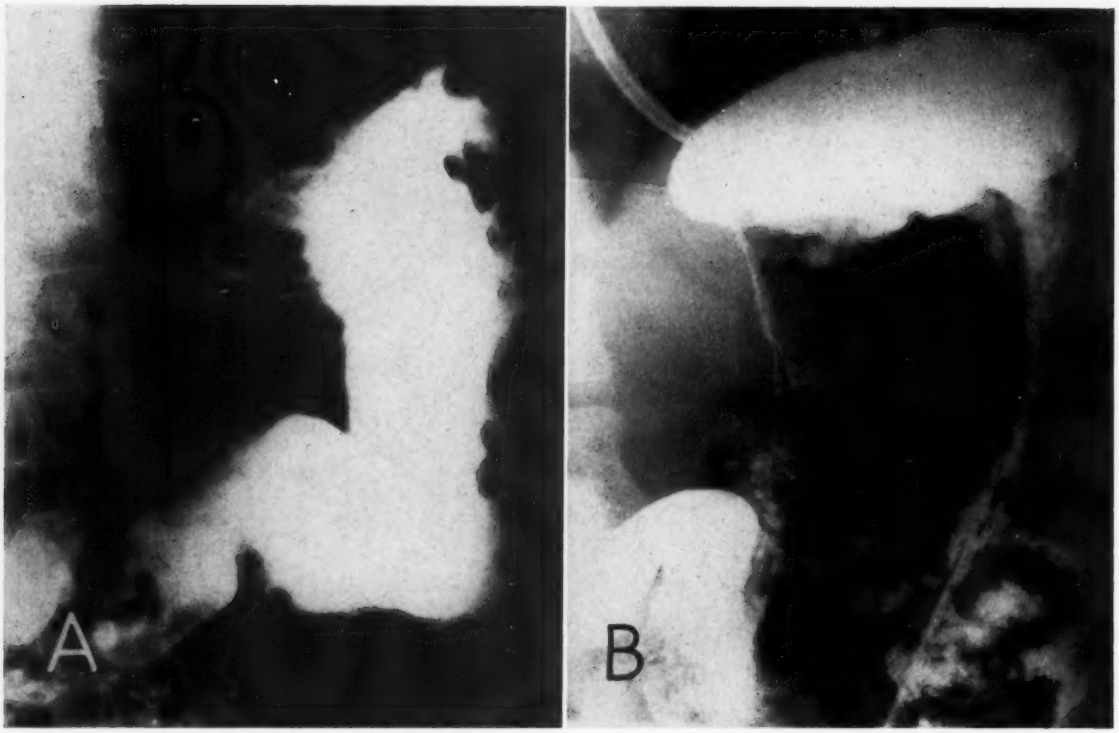


FIG. 4. (*A*) Spot film of the stomach, showing the marked irregularity of the gastric mucosa, both in the fundus and along the greater curvature. (*B*) Spot film made with the patient in Trendelenburg position and most of the barium collected in the fundus of the stomach. Note how smoothly it is outlined at present. Note also that the greater curvature of the stomach is filled out very well, and in other films made in the right anterior oblique position the greater curvature of the stomach showed a smooth "profile line."

ing what we have called the "profile line" of the mucosa in the questionable areas.

The "profile line" is produced when a thin layer of barium is trapped between the wall of the balloon and the gastric mucosa. (Fig. 1). It has been our experience that the "profile line" is seen whenever normal mucosa is present but is not seen with pathological infiltration of the mucosa. Particular attention should be paid to the "profile line" in the illustrations (Fig. 2 and 7).

Table II is a correlation of the clinical, roentgen, surgical, and pathologic findings in the 16 cases with proved pathology.

It should be noted that in most of these patients a pathologic process was suspected on the routine study, but the balloon method gave us much more specific information concerning the location and extent of the lesions.

Case 9 (Fig. 3), during the routine gastrointestinal study, had few suspicious findings. However, the balloon study revealed a rather extensive lesion of both the fundus and lesser curvature. In this particular case, this special procedure was needed to convince the surgeon of the necessity for operation. In several of the other cases, the balloon study impressed all with the extent of the lesion (Fig. 6, 7 and 8).

Another value of this method to us has

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FIG. 6. Case 16. (*A*) Right anterior oblique film of the barium-filled stomach, showing some irregularity about the esophageal hiatus. (*B*) Same case as (*A*), showing the balloon in the stomach and the marked irregularity about the esophageal hiatus. Note the loss of the "profile line" along the lesser curvature, just inferior to the esophageal hiatus. Note also the extensive diverticulosis of the small intestine.

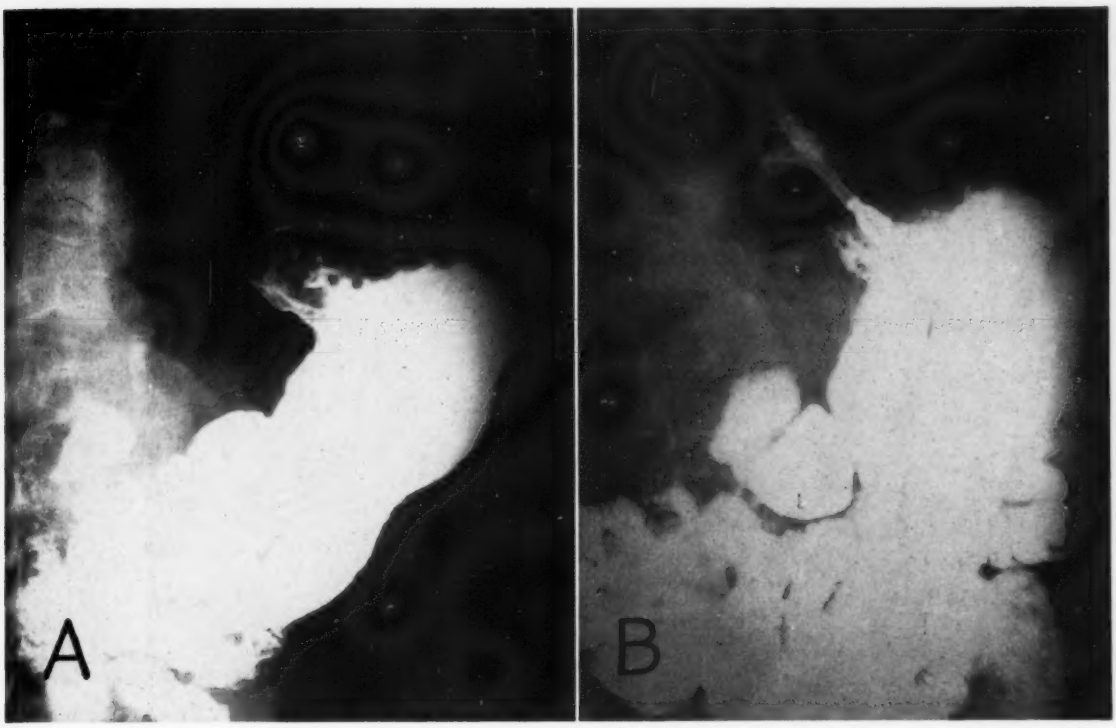

Fig. 5. (*A*) Right anterior oblique film of a barium-filled stomach, showing no definite evidence of pathology No additional findings were found roentgenoscopically. (*B*) Same stomach as (*A*), with a balloon in place, partly inflated, and a little traction made on the tube, demonstrating a hiatus hernia which was not suspected on any of the routine studies, including those made with the patient in Trendelenburg position.

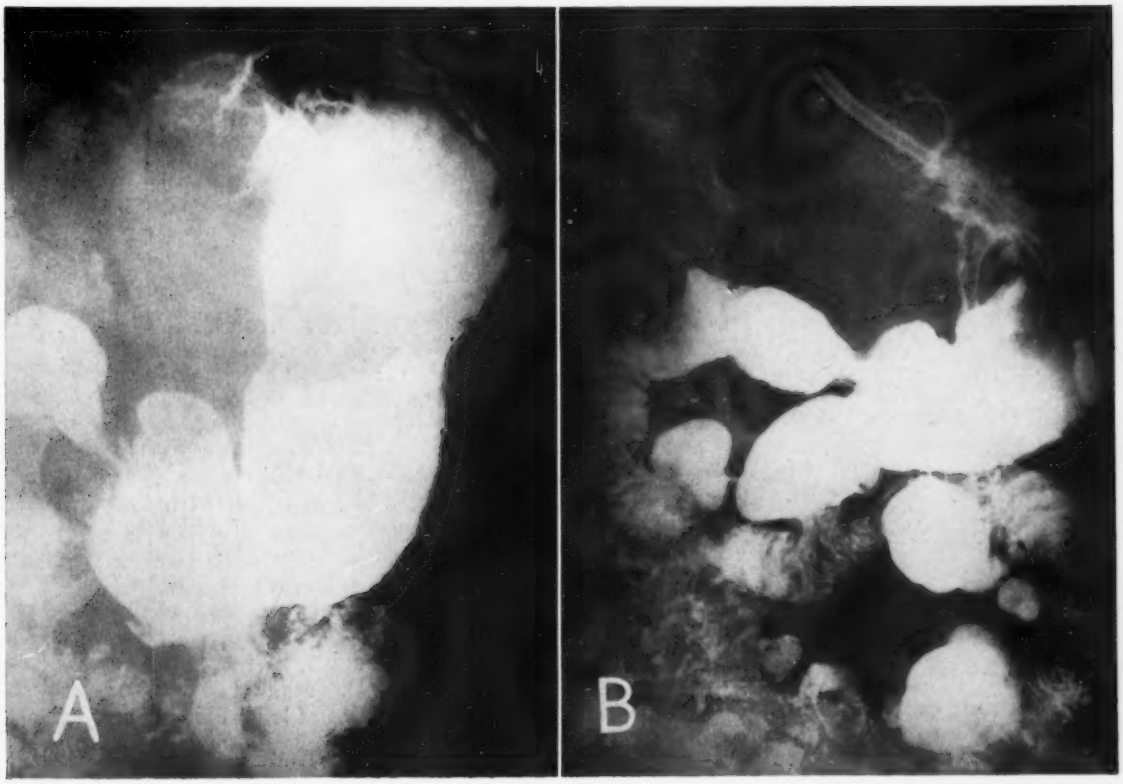

FIG. 7. Case 5. Lateral view of the stomach, showing normal "profile line" superiorly, posteriorly, and inferiorly, with the areas of infiltration of the anterior gastric wall well demonstrated by the loss of the normal "profile line" in those places.

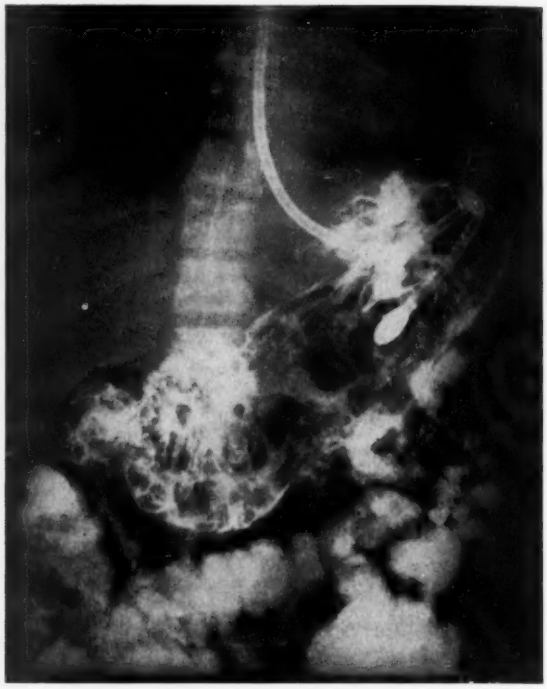

FIG. 8. Case 1. Anteroposterior film of the barium-filled stomach with the balloon, showing marked polyposis throughout the entire stomach. Also note at the esophageal hiatus the overhanging ledge and the loss of normal "profile line" just inferior to the gastric tube as it enters the stomach, which was found to represent a large adenocarcinoma, superimposed on these gastric polyps.

been our increased ability to specifically pick out the so-called "false positives," such as is illustrated in Figure 4. It is in cases such as this, with persistent irregularities out of reach of the palpating finger, that this method of internal palpation has been of considerable help. Several small hiatus hernias have also been demonstrated by this method which were not suspected during the routine examination (Fig. 5).

SUMMARY

1. Clinical experiences in the use of controlled intragastric pressure are presented.

2. Stereoscopic roentgenograms of the distended gastric fundus are of value.

3. The "profile line" has been of considerable value in differentiating between intrinsic and extrinsic lesions of the stomach.

4. Another practical value of this method has been in eliminating the so-called "false positive" cases.

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THE ROENTGEN APPEARANCE OF INTESTINAL POUCHES FOLLOWING LATERAL ANASTOMOSES*

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RECENTLY our attention was directed to the problem of blind pouch formation, following side-to-side intestinal anastomoses after division of the bowel by several cases which presented characteristic roentgen findings. A search of the radiological literature failed to reveal any comprehensive article dealing with this subject. A review of the material at the Jewish Hospital of St. Louis, disclosed 6 cases of this abnormality, several of which had previously been diagnosed incorrectly or entirely overlooked. These 6 cases, plus a review of the literature, form the basis of the present report.

Recognition of this condition is important because of the frequent production of symptoms which may stimulate partial intestinal obstruction, and also because of the complications which it may give rise to, including perforation and macrocytic anemia. The surgical implications of these 6 and 2 additional cases are set forth in another communication.[9]

The mechanism of the formation of blind pouches following lateral anastomoses is schematically illustrated in Figure 1. In the text of this article, the term "lateral" is used instead of side-to-side in describing the type of intestinal anastomosis.

REVIEW OF LITERATURE

Cannon and Murphy,[3] in 1906, made roentgenoscopic observations of the changes in the alimentary tract of cats following lateral anastomoses of the small intestine. If the blind ends extended beyond the anastomotic opening, it was observed that the proximal closed loop was in danger of becoming packed with hardened waste. They stated that the circular fibers in lateral anastomoses destroyed efficient peristalsis at the junction and the blind pouches consequently failed to empty completely.

Rankin, Bargen and Buie[14] pointed out that lateral anastomoses result in two blind ends of intestine, the proximal of which acts as a reservoir for foreign matter, which occasionally gives rise to untoward complications. They noted that specimens removed at necropsy years after such operations revealed hypertrophy and elongation of the blind end of the intestine. Estes and Holm[5] reported 2 cases of complete obstruction in the terminal ileum resulting from adhesions in which lateral anastomoses were performed. Following the anastomoses, the patients developed diarrhea, borborygmus, abdominal distention, marked weight loss, and debility. In each patient, complete recovery followed resection of the side-tracked loop which was greatly elongated, markedly dilated, and ulcerated. Holm[10] produced intestinal obstruction in the terminal ileum of 7 dogs

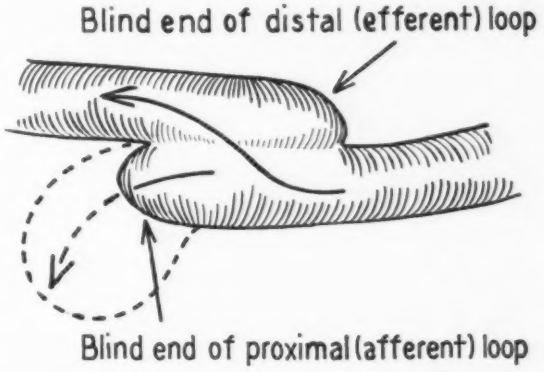

FIG. 1. Schematic representation of the mechanism of blind pouch formation following lateral (side-to-side) intestinal anastomoses. This complication has not been described in end-to-side anastomoses.

* From the Departments of Radiology and Surgery, The Jewish Hospital of St. Louis, aided by the Louis Monheimer Fund.

following which various types of lateral anastomoses were performed allowing the side-tracked loops to remain. Following operation, all the dogs developed diarrhea, borborygmus, distention, weight loss, and debility. Two of the dogs died from generalized peritonitis resulting from perforation of the side-tracked loops. In all 7 animals, the side-tracked loop was found to be markedly elongated, greatly dilated, and ulcerated.

Experiments to determine the fate of these blind loops were performed by Pearse[12] on 60 dogs. Blind loops of various length were observed under the roentgenoscope after they had been filled with barium. Peristalsis was seen to begin near the anastomosis and sweep toward the blind end. As the strength of the waves increased, the incisura caused by them deepened, and barium was carried up to the blind end which became dilated. He concluded that, when the direction of the peristaltic current is away from the blind end and toward the anastomosis, the segment of intestine remains empty. In the segment above the obstruction where the peristaltic current is from the anastomosis toward the blind end, material is carried into and retained in the blind segment.

Pickhardt[13] described the case of a young girl operated at the age of five years for cecal ulcer with lymph node hyperplasia. An ileotransverse colostomy with side-to-side anastomosis was performed and the short circuited portion of intestine was resected. Four years later the blind ends of the hepatic flexure and the ileum had increased greatly in size to form pouches. The large intestinal pouch measured about 9 cm. in length while the ileal pouch measured 14 cm. in length. Five years later, the large intestinal pouch had changed comparatively little in length while the ileal pouch had increased about 50 per cent in length. He concluded that the larger small intestinal pouch was a menace and a potential source of danger from the standpoint of obstruction, either within itself or by pressure upon other portions of the intestinal tract.

Ginzburg, Colp and Sussman[7] found 2 instances of dilated blind pouches which could be demonstrated clinically in a series of 32 cases of ileocolostomy with exclusion, in which the side-tracked loop was not removed. One of these was identified by roentgenologic evidence although complete description of the roentgen findings was not given. In a third case, the formation of tension ulcers in the blind loop produced symptoms of peritonitis which required surgical intervention. They also studied intestinal mechanics and morphology in 22 cases following a barium meal. These studies revealed that the ileal loop directly proximal to the anastomosis or immediately adjacent to it was dilated in almost one-third of the cases. They concluded that the only site at which definite pathological alteration occurred as a result of the operative procedure of ileocolostomy with exclusion was in the blind end of the terminal ileum used in a side-to-side anastomosis.

Black and McEachern[2] collected 5 cases from the files of the Mayo Clinic in which symptoms could be attributed to blind segments of small intestine left after division of the intestine and lateral union. In 3 cases right hemicolectomy with bowel restoration by lateral ileotransverse colostomy had been performed. Two of these cases presented symptoms suggestive of partial obstruction, while the other developed a fecal fistula following perforation of the blind pouch. Cures resulted when, in 1 case, resection of the anastomotic stoma and blind pouch and end-to-side anastomosis was performed, and when the other 2 had their pouches resected. A fourth case with an old lateral jejunojejunostomy developed acute abdominal symptoms from the perforation of a blind pouch of proximal jejunum resulting in peritonitis and abscess formation. The blind pouch was resected but pneumonia developed and the patient died. The fifth case with a four year old antiperistaltic side-to-side ileo-ileostomy developed cramping abdominal pain, vomiting, distention and constipation. At operation, the proximal blind end of ileum

had dilated to a size larger than a normal stomach. The stoma and both blind ends were resected and continuity re-established by end-to-end anastomosis. In this series, gastrointestinal examinations were made in 4 cases and in only 2 of these was the diagnosis of a dilated blind loop of ileum made, preoperatively. Lack of visualization of the blind pouch may be due to the presence within it of inspissated stool or secretion preventing the entrance of barium

CASE REPORTS

Case 1. R. G., a white female, aged fifty-one, was admitted to the hospital September 14, 1932, with the history that an annular constricting adenocarcinoma of the lower descending colon had been resected nine years earlier and a side-to-side anastomosis had been performed between the upper part of the sigmoid and the proximal descending colon. Since the operation, she experienced periodic attacks of abdominal cramps in the left lower quadrant sometimes relieved by passage of gas and atropine. There was occasional nausea but vomiting was rare. The patient was somewhat constipated and used laxatives occasionally. Her appetite was only fair and she complained of lassitude and general fatigue. The abdomen was soft but distended. There was tenderness on deep pressure over the right lower quadrant. The liver was palpable just below the costal margin. Laboratory data revealed a normal urine. White blood cell count 8,100, red blood cell count 4.2 million; hemoglobin 12.3. Stools were negative for parasites and occult blood.

Fig. 2. Case 1. Flat film of the abdomen made in November, 1938, five years following the colocolostomy showing the greater portion of the left half of the abdomen occupied by a huge quantity of firmly packed stool in association with gaseous distention of the splenic flexure.

Fig. 3. Case 1. The twenty-four film showing marked retention of barium within the distended, large intestinal pouch, the lower border of which is indicated by the arrows.

Roentgen examination made in November, 1938 (Fig. 2), showed the left half of the abdomen to be occupied by firmly packed stool with considerable gas, especially in the region of the splenic flexure. This was interpreted as a large intestinal pouch of undetermined origin. A gastrointestinal series on January 17, 1939, showed marked displacement of the stomach, duodenal bulb and duodenal loop to the right. The proximal jejunal loops were displaced downward and medially by the huge left upper quadrant mass. A twenty-four hour film (Fig. 3) and barium enema (Fig. 4), showed a huge

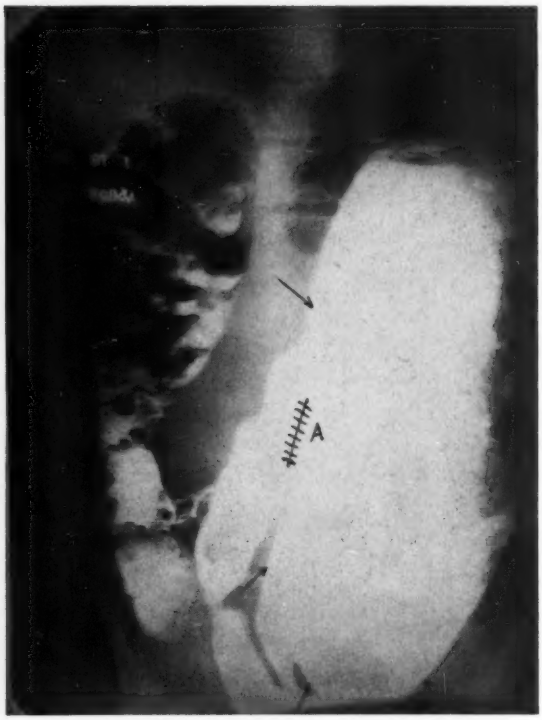

FIG. 4. Case 1. The film after the barium enema showing the huge size of the fully distended blind pouch. The capacity of the pouch when distended was probably greater than the remainder of the colon. The anastomotic site, *A*, is displaced to the right by the distended pouch.

blind intestinal pouch formed from the large intestine which occupied the entire left half of the abdomen. This pouch was seen to have a volume equal to, if not greater than, the remainder of the colon. The site of anastomosis was displaced to the right by the greatly distended loop.

The patient was operated upon on September 29, 1942, and the blind loop of colon, with its mesentery, was resected. The findings at the time of operation are schematically illustrated in Figure 5. The pathologic report described a dilated blind loop of intestine measuring 34 by 16 cm. The mucosa was flattened as a result of pressure and was hemorrhagic. Microscopically, the glands were diminished in number and there were areas of hemorrhage and lymphocytic infiltration. There was considerable edema of the submucosa although the muscularis and the serosa were apparently normal. This patient is living and free of symptoms at the present time.

Comment. This case is most unusual because it represents the only blind pouch formation following the lateral large intestinal anastomosis which we have encountered and we have not found a similar case in the recent literature. Lateral anastomosis of the loops of the colon in large intestinal carcinoma has been almost completely abandoned, hence probably the extreme

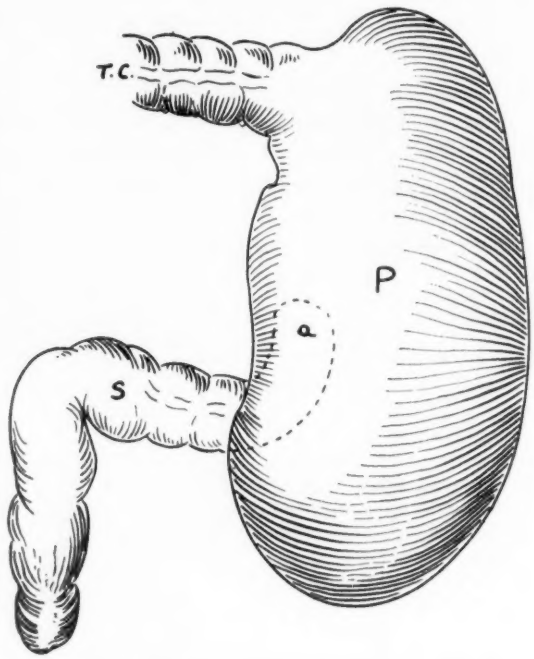

FIG. 5. Case 1. Schematic drawing of operative findings. *P*, the huge blind pouch; *a*, the anastomotic site; *S*, the sigmoid colon.

rarity of this condition. Another unusual feature is the tremendous size which the blind pouch reached as early as five years after operation. The tremendous distention of the blind loop of colon undoubtedly was responsible for symptoms in this case. Distention, periodic attacks of abdominal cramps, and general fatigue and lassitude disappeared after operation.

CASE II. R. K., white male, aged forty-nine, was admitted to the Jewish Hospital, on November 27, 1948, with the history that, in 1939 he was struck in the abdomen with a piece of wood which punctured the intestine in two places. He was immediately operated upon and

the perforations closed. In January, 1941, the patient was readmitted because of bouts of cramping pains in the mid-abdomen followed by alternate periods of diarrhea and constipation. A diagnosis of partial small intestinal obstruction was made. There were intestinal patterns visible in the left lower quadrant of the abdomen.

At operation, a colon bacillus abscess was found at the site of the previous perforation. There was also a question of an obstructive band noted in this region. A primitive Meckel's diverticulum was seen but was not removed. The patient was readmitted on September 6, 1941, with an acute abdomen which was thought to be due to the Meckel's diverticulum but, on exploration, a segment of gangrenous ileum, caused by dense fibrous adhesions, was found. Two feet of gangrenous intestine was resected and a lateral anastomosis was performed. Since the second admission in September, 1941, the patient has had occasional attacks of vague epigastric pain.

A gastrointestinal roentgen examination (Fig. 6) made on August 11, 1947, showed a well defined intestinal pouch measuring about 4 by 7 cm., best demonstrated on the three hour small intestinal study. On the day before the present admission, the patient was seized with cramping pain in the right lower quadrant which increased in severity. There were no bowel movements and only fair results were obtained with an enema. There had been nausea and vomiting the preceding evening. There was no abdominal distention. There was bilateral voluntary abdominal muscle guarding with some rebound tenderness and more tenderness in the right lower quadrant. Intestinal peristalsis was slightly increased. Flat and upright films of the abdomen made at this time showed gas-fluid levels within the small intestine and some gas in the large intestine. The abdominal pain increased in severity, especially in the right lower quadrant and the suprapubic area and there was increase in rebound tenderness.

An exploratory laparotomy was performed on November 29, forty-eight hours after admission. An adhesive band was found which produced a closed loop-type of obstruction. There was a moderate amount of clear fluid in the abdomen. The dilated blind pouch of small intestine which had been identified on the previous small intestinal study was also found but apparently had no presenting symptoms. The adhesions were freed, and the abdomen was closed. The postoperative course was uneventful.

Fig. 6. Case II. Small intestinal pouch, 4 by 7 cm., indicated by arrows, well demonstrated on three hour film of intestinal series.

Comment. The blind, small intestinal pouch which had developed in this case was only identified upon review of the films after our interest was attracted to this type of abnormality. The pouch was identified at operation but because of its size, and, because of the fact that the patient was in poor general condition, no attempt was made to remove it. The blind pouch was not thought to represent a part of the clinical picture in this case.

Case III. A. M., a white male, aged seventy-three, was admitted to the hospital for the first time on February 17, 1940, with a history of intermittent colicky pains and vomiting of eighteen hours' duration. There was a past history of appendectomy, cholecystectomy, herniorrhaphy and prostatectomy. The patient had a normal bowel movement on the morning of admission, although there had been bloody vomitus. Blood pressure 190/90, pulse 72. The

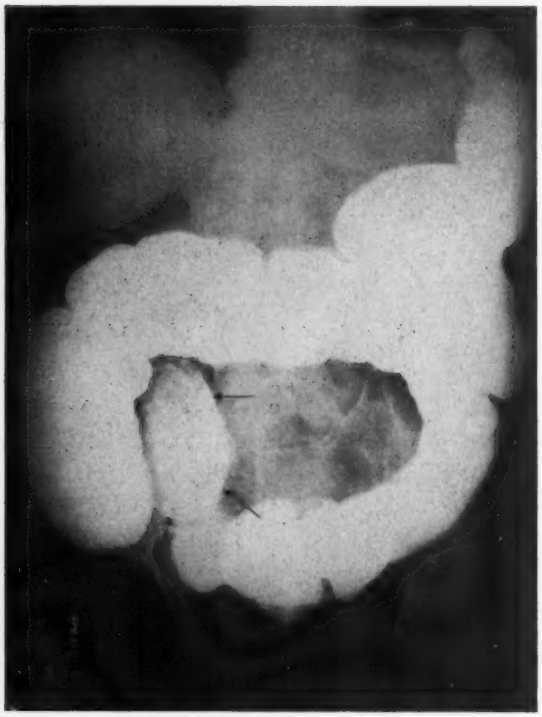

FIG. 7. Case III. Barium enema film showing the filled colon and the dilated distal ileal loop indicated by the arrows. This pouch was recognized only after a twenty-four hour residue was found within it prior to the barium enema examination.

patient was very apathetic. The right lower quadrant of the abdomen seemed distended. There was tenderness, muscle guarding and rebound pain centered mainly around the lower end of the cholecystectomy scar. Intestinal patterning was visible through the abdominal wall.

Laboratory data: White blood cell count 32,000 with a differential count of 28 per cent stab forms, 60 per cent segmented forms, 12 per cent lymphocytes. Non-protein nitrogen 40. Urinalysis: albumin 3 plus, acetone trace. Films of the abdomen in the upright position revealed fluid levels with distention of small intestine. There was no gas in the large intestine. An emergency operation was performed through a right paramedian incision. Five feet of gangrenous lower ileum were found which resulted from a fibrous band running from the right lateral parietal peritoneum to a loop of small intestine. The bowel was strangulated by this adhesive band and did not return to its normal color when the band was cut. Exteriorization was done by bringing the loops together with sutures and the bowel was removed at once. A through-and-through closure was performed. On March 20, 1940, an intestinal exclusion operation was performed with a side-to-side enteroenterostomy.

The patient was discharged from the hospital on April 17, 1940. On June 20, 1940, the second stage exclusion was performed, the excluded loops being excised together with a skin scar and normal layer repair of the abdominal wall was done. The postoperative course was excellent.

The patient was readmitted on October 23, 1945, to the medical service because of attacks of cramping abdominal pain and loose stools. A macrocytic anemia was found but the picture did not fit in with pernicious anemia, sprue or pancreaticogenic diarrhea. Stool cultures were negative for parasites of other pathogens.

In January, 1948, laboratory studies showed a white blood cell count of 4,300, red blood cell count of 2.94 million, and hemoglobin of 11.3 gm. Anisocytosis, poikilocytosis, mast cells and many macrocytes were found. Following liver therapy, laboratory examination showed a white blood cell count of 5,200, red blood cell count of 1.62 million, hematocrit of 20 per cent, and hemoglobin of 6.0 gm. (39 per cent). The blood smear showed hypochromasia, occasional macrocytes and marked anisocytosis and poikilocytosis. Gastric analysis revealed no free hydrochloric acid, but one-half hour after histamine, hydrochloric acid appeared. The sternal marrow showed normal elements.

Gastrointestinal series on September 2, 1948, showed a blind pouch in the terminal ileum. This was first recognized as a twenty-four hour residue of barium in a greatly distended distal ileal loop (Fig. 7) and was also identified in retrospect on the three hour small intestine film. The barium enema confirmed the fact that the large pouch was part of the terminal ileum, the pouch having remained filled from the previous upper gastrointestinal examination. The postevacuation film (Fig. 8) showed complete retention of barium in the pouch after the colon had been partially emptied of barium. Despite treatment with parenteral liver, feosol and kaolin, the patient continued to have diarrhea. Further treatment in the form of eight blood transfusions was given. Because of the poor general physical condition, he was treated conservatively, with some improvement in the diarrhea and the anemia.

Comment. This is a striking case of a large pouch in the terminal ileum which resulted from a previous side-to-side anastomosis following an exclusion operation for strangulation obstruction of the small intestine. The intractable diarrhea and the anemia have been described in association with blind small intestinal pouches. This is the only case in our series in which anemia was a constant finding. Had the patient been in better general physical condition, resection of the blind intestinal pouch would have been performed and probably would have resulted in a complete cure. The pouch was not identified until it reached sufficient size to produce twenty-four hour stasis.

The occurrence of macrocytic anemia in association with blind intestinal pouches deserves special comment. The first description of the occurrence of this type of anemia with intestinal strictures was made by Faber[6] in 1897. He reported a case of pernicious anemia occurring in a young woman with fibrous thickening and stricture formation in the distal part of the jejunum, demonstrated at autopsy. Since this time, a very extensive literature has appeared on this subject. Horster[11] produced an anemia by creating blind pouches and strictures in intestines of dogs. Barker and Hummel[1] collected 49 cases of macrocytic anemia associated with intestinal strictures or anastomoses and added 2 cases of their own. The pathogenesis of this form of macrocytic anemia appears to be intimately bound up with stagnation and putrefaction of intestinal contents resulting, perhaps, in the absorption of toxic substances. The successful treatment of the anemia usually depends upon the surgical removal of the cause for the intestinal stagnation. Eckel and Holman[4] reported the case of a fifty year old white woman who, after a right hemicolectomy and a lateral ileocolostomy, developed an anemia with 2.17 million red cells with a hemoglobin of 40 per cent. This was associated with a history of vague abdominal pain, occasional attacks of diarrhea of ten years' duration, weight loss and weakness. A gastrointestinal series showed partial obstruction in the region of the terminal ileum. At operation, a distended blind pouch of ileum measuring 10 inches in length was found at the site of the previous ileocolostomy. Simple removal of this pouch resulted in complete cure. The blood picture was normal two years later.

Fig. 8. Case III. The postevacuation barium enema film showing the colon almost emptied of barium. Aside from the main oval pouch, there is distended small intestine inferior and medial to it which may represent intestine proximal to the anastomosis distended as a result of incomplete obstruction in this region by the dilated pouch.

The most recent reference to this subject is found in an article by Watson, Cameron and Witts,[15] who, by creating blind intestinal loops in rats, consistently produced macrocytic anemia. This anemia responded readily to treatment with liver extract.

Case IV. B. G., a white female, aged seventy, was admitted to the Jewish Hospital on November 8, 1948. In June, 1944, 5 feet of ileum containing three distinct areas of lymphosarcoma were resected. Intestinal continuity was re-established by side-to-side anastomosis

FIG. 9. Case IV. The four hour serial small intestinal film showing the large, small intestinal pouch in the lower mid-abdomen partially filled with barium. The blind end of the pouch is air containing. The rugal folds are prominent. Several negative shadows, indicative of retained intestinal contents, can be seen with the pouch. (Retouched)

after turning in the bowel ends. Partial omentectomy was done for a secondary lymphosarcomatous mass in the omentum. Radiation therapy was given postoperatively.

Except for chronic constipation and occasional gas pains, the patient remained well until three weeks before admission at which time she had an attack of dull cramping abdominal pain, borborygmus and distention. These attacks recurred with increasing severity. She was examined during three of these attacks and on two occasions, concurrent with a peristaltic wave of great intensity, an abdominal mass about 4 inches in diameter could be felt to appear and disappear in the subumbilical area. Laboratory data showed normal urine and blood counts.

A small intestinal study on November 10, 1948 (Fig. 9), showed an isolated loop of distended small intestine with prominent rugal markings, containing gas and barium. There was normal intestinal motility and no signs of obstruction. A few days later barium was injected through a Miller-Abbott tube which had been passed as far as the mid-portion of the small intestine. The dilated loop of small intestine was again visualized and no obstruction was demonstrated. A preoperative diagnosis of recurrent lymphosarcoma was made.

Operation was performed on November 18, at which time the blind end of the proximal loop was found to be dilated to about 4 inches in diameter. When fully distended, the pouch compressed the ileum distal to the anastomosis, possibly accounting for the unusual physical findings. There was no evidence of lymphosarcoma. The area was resected and an end-to-end anastomosis was performed. The postoperative course was uneventful and the patient is now symptom free. The resected portion of the small intestine was distended with barium and a roentgenogram was made. This demonstrated the blind, small intestinal pouch (Fig. 10, *A* and *B*).

Comment. In this case, the blind pouch of small intestine was noted roentgenographically but was incorrectly interpreted as representing recurrent lymphosarcoma. Suspicion should have been aroused by the absence of distention of bowel proximal to the abnormal loop and by the absence of obstruction of barium given by mouth or via the Miller-Abbott tube. However, lymphosarcomatous involvement of the small intestine has been known to produce local increase in caliber of the lumen of the intestine. This is believed to be due to early involvement of the submucosa with paralysis of its nerve plexuses. No anemia was present in this case although the other symptoms were definitely attributable to the blind pouch, since they disappeared following its resection.

CASE V. E. P., a white female, aged sixty-six, was admitted January 25, 1949, with the history that in December, 1946, a large polypoid adenocarcinoma of the hepatic flexure was found and a right hemicolectomy with side-to-side isoperistaltic ileotransverse colostomy was performed. Three weeks before the present admission, occult blood was noted in the stool and a recurrence was suspected. Physical examination showed a moderate arterial hypertension, and hypertensive cardiovascular disease. The urine and blood counts were normal.

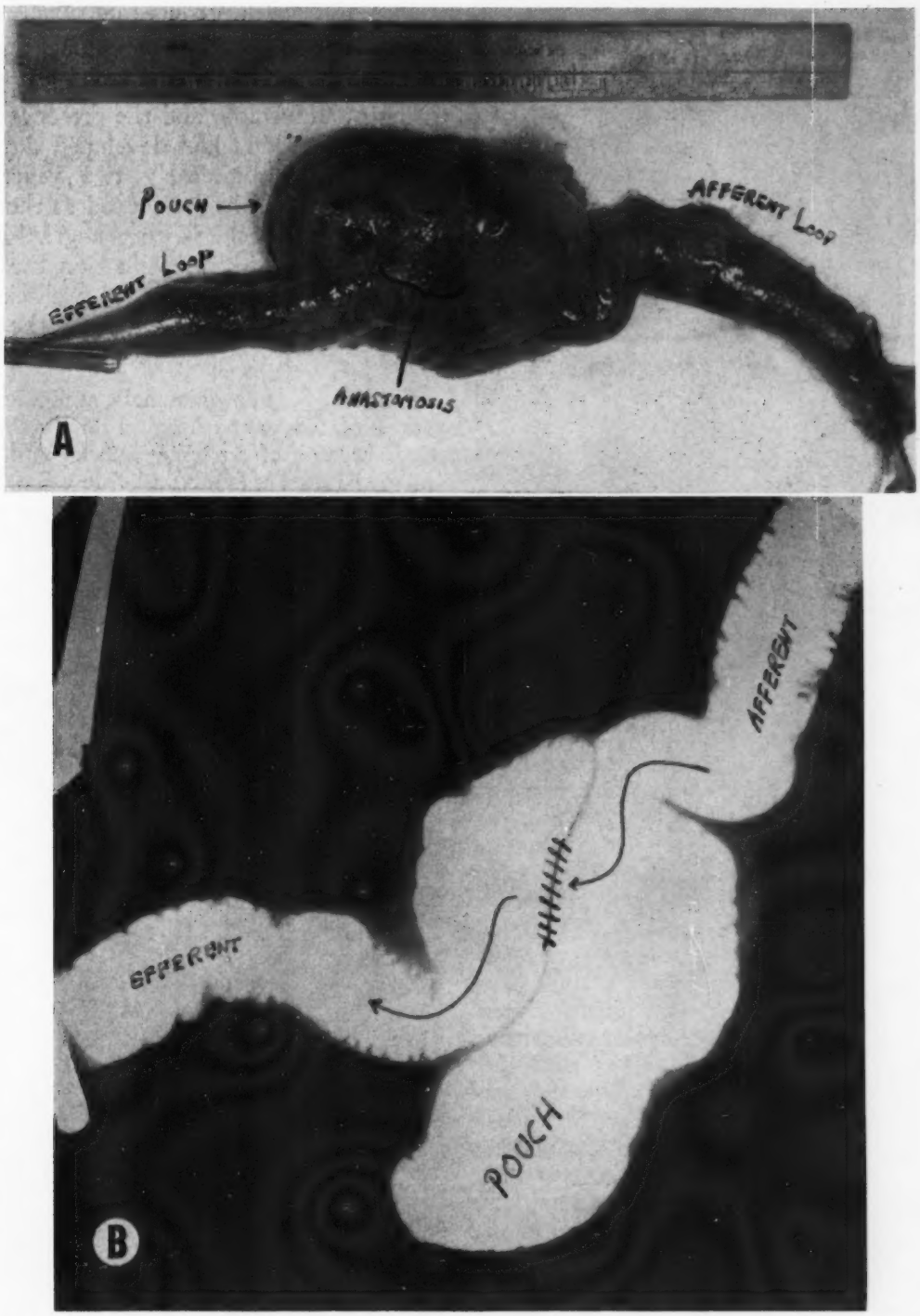

Fig. 10. Case IV (*A*). Photograph of the operative specimen seen from behind. The pouch has been rotated for better visualization. The approximate location of the anastomotic site is indicated. (*B*) Roentgenogram of operative specimen filled with barium. Arrows indicate direction of flow of intestinal contents. Cross hatch indicates probable site of anastomosis.

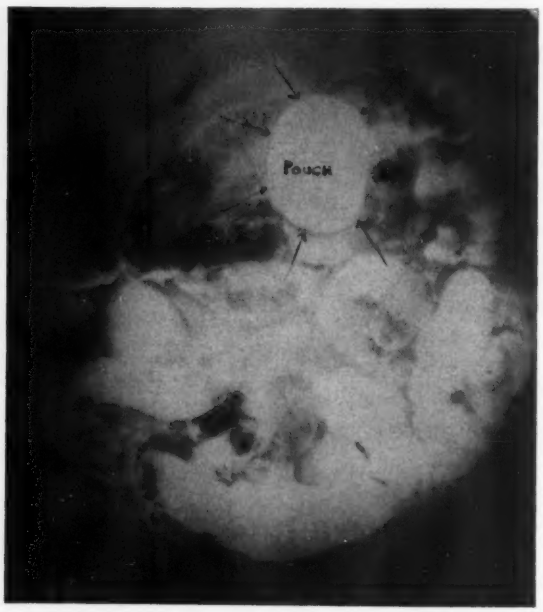

Fig. 11. Case v. Postevacuation air contrast visualization of the colon showing the well circumscribed barium collection in the upper mid-abdomen representing the blind pouch of ileum from the previous ileotransverse colostomy. (Retouched)

Barium enema showed two annular filling defects, one in the transverse colon near the splenic flexure, and the other in the descending colon, just distal to the splenic flexure. Air contrast visualization of the large intestine made on two occasions showed a rounded, well circumscribed collection of barium which was interpreted as the dilated blind pouch of terminal ileum at the site of the ileotransverse colostomy (Fig. 11).

On February 3, 1949, operation was performed at which time two polypoid carcinomas were found at the sites indicated by the roentgen examination. These were apparently unrelated to the previous carcinoma of the hepatic flexure. The terminal ileum, the anastomotic stoma, the remaining transverse colon and the descending colon, including the two carcinomas, were resected and an end-to-side union established between the ileum and the sigmoid colon. The patient stood surgery well, but a lower nephron syndrome developed with failure to excrete urine. In spite of the use of the artificial kidney, the patient died on February 8, 1949. The specimen removed at operation showed, in addition to the carcinomas, a saccular dilatation of the blind ileal pouch, 5 inches long and 3 inches wide. So far as is known, this pouch produced no symptoms.

Comment. This case is of interest because of the occurrence of three separate carcinomas of the colon, and the presence of an ileal pouch which had developed during a period of approximately two years. No symptoms could be attributed to the presence of the pouch. Roentgenographically, it could be readily identified on the postevacuation film as a rounded, well circumscribed collection of barium in the midportion of the upper abdomen.

CASE VI. S. H., a white male, aged sixty-one, was admitted to the hospital on October 17, 1946, because of cramping intermittent pains in the abdomen of four months' duration. There had been no weight loss and the bowel movements were normal. Seventeen years earlier, in Germany, a carcinoma of the cecum was exteriorized and resected, leaving a double-barrelled cecostomy. An ileotransverse colos-

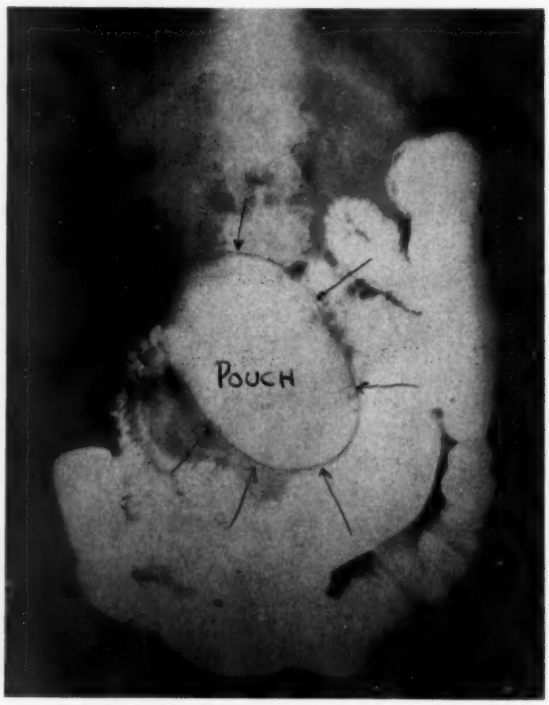

FIG. 12. Case VI. Postevacuation enema film showing large collection of barium in the mid-abdomen produced by this large ileal pouch in the region of the previous ileotransverse colostomy. (Retouched)

tomy was done later leaving the colostomy stoma functionless.

The physical examination was negative. The roentgen examination of the large intestine by barium enema showed an annular filling defect in the transverse colon proximal to the splenic flexure. On the postevacuation film (Fig. 12) a large, fairly well circumscribed collection of barium was noted in the mid-abdomen.

Laboratory data showed a white blood cell count of 9,350, red blood cell count of 3.79 million and a hemoglobin of 11.2 gm. (73 per cent). On October 24, 1946, operation was performed and resection of carcinoma of the transverse colon with end-to-end anastomosis was performed. A large ileal pouch was identified in the region of the previous ileotransverse colostomy (Fig. 13). The patient made an uneventful recovery and was discharged November 14, 1946.

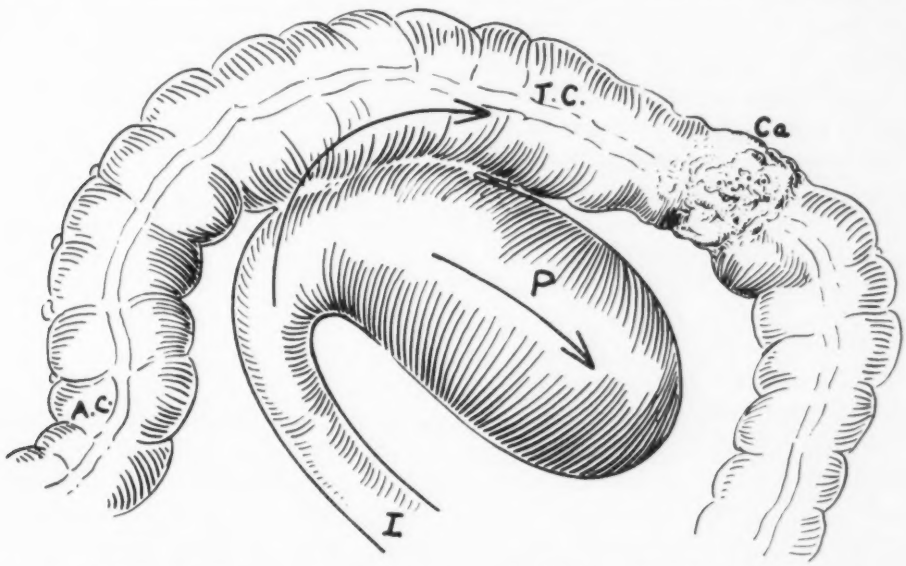

Fig. 13. Case VI. Schematic representation of the operative findings. The large ileal pouch demonstrated on the post evacuation enema film is seen, *P*. The second carcinoma site is indicated, *Ca*. The ascending colostomy was functionless.

Comment. In this case of multiple large intestinal carcinomas, the opportunity of inspecting the previous ileocolostomy site presented itself and the ileal pouch was identified by its roentgen appearance. In spite of the large size of the pouch in this case, the patient has had no symptoms referable to it.

DISCUSSION

It has been established on the basis of experimental and clinical observations that blind pouches develop from the proximal closed loop following lateral intestinal anastomoses. These can probably be prevented if the inverted ends of the intestinal loops do not extend beyond the anastomotic opening and if the united ends of the intestine are made as short as possible. This complication can be entirely prevented if end-to-end union is effected whenever intestinal anastomosis is needed. It is with this is mind that one of us (C.J.H.)[8] has described a technique for end-to-end intestinal union which accomplishes safe union without narrowing the lumen. It is very likely that the greatest number of these blind intestinal pouches go unrecognized because they are asymptomatic. Black and McEachern[2] have observed repeatedly at the second stage of two-stage right hemicolectomy that redundancy had developed distal to the anastomosis in the end of the proximal segment of bowel after division of the bowel and lateral ileocolostomy. Observations at necropsy in patients who had lived for prolonged

periods without symptoms revealed such short redundant segments. Even when the pouch becomes hypertrophied and elongated, symptoms need not necessarily be present.

Complications which can occur when a blind intestinal pouch is present are perforation, anemia, diarrhea, and vague intestinal complaints, some suggesting incomplete intestinal obstruction. In our series of 6 cases, in which pouch formation was demonstrated, 3, or 50 per cent, presented symptoms directly attributable to the blind pouch. Of these, 1 occurred in the large intestine (Case I), the remainder in the small intestine. The occurrence of macrocytic anemia in association with blind intestinal pouches has been recognized for a long time. It has been observed clinically and produced experimentally by many investigators.[1,6,11,15] The pathogenesis of this anemia has not been established but apparently depends upon dilatation of the blind loop with accumulation within it of intestinal contents. In Case III, diarrhea and macrocytic anemia were the outstanding features in association with a distal ileal pouch which resulted from a previous lateral anastomosis following an exclusion operation for strangulation obstruction of the small intestine. Complications can be prevented by resection of the blind intestinal pouch.

The roentgen identification of intestinal pouches should offer few difficulties if these lesions are kept in mind whenever cases with lateral intestinal anastomosis are examined. These blind pouches can be identified both on the small intestinal serial study and on the barium enema, particularly the postevacuation film. Air contrast visualization may be helpful. In the serial small intestinal study, attention is directed to the presence of a blind pouch because of retention of a well circumscribed collection of barium after all the barium has cleared the small intestine. This barium collection can be readily differentiated from a diverticulum or a congenital Meckel's pouch because of the frequent large size which they attain, and their usual location in the upper mid-abdomen. They are usually oval to round in shape and may show a considerable twenty-four residue (Case III). With the barium enema, the pouch may be obscured by the filled colon but is readily identified as a rounded, well circumscribed collection of barium in the mid-abdomen on the postevacuation film. There may be twenty-four hour retention after the barium has cleared the remainder of the colon, if the pouch has reached considerable size. Pouches can reach a modest size (3 by 5 inches) as early as two years following lateral anastomosis. Our single case of large intestinal blind pouch (Case I) developed within five years after operation into a sac which occupied the entire half of the abdomen.

SUMMARY

(1) Attention is directed to the roentgenologic appearance of blind pouches following lateral intestinal anastomoses.

(2) Six cases in which blind pouches were demonstrated roentgenologically are recorded. Five of these occurred in the small intestine and one in the large intestine. Three of the patients had symptoms directly attributable to the presence of the pouch.

(3) Obscure gastrointestinal symptoms such as colicky abdominal pain, distention, nausea, and vomiting may be explained by the roentgen demonstration of a blind intestinal pouch. Macrocytic anemia may also be caused by this abnormality.

(4) Attention may be directed to the pouches by barium retained within them after evacuation of a barium enema or during barium studies on the small intestine.

(5) Unwarranted surgery can be avoided or curative surgery can be performed if the correct interpretation of the roentgen findings is made.

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SINOBRONCHITIS IN CHILDREN

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THOUGH sinobronchitis is a relatively common condition in children, it is surprising to ascertain that very little appears on the subject *per se* either in pediatric textbooks or in the pediatric literature. This dearth of reports is probably due to the general failure of recognizing this condition as a distinct clinical entity. In the past, a variegated and complicated nomenclature was employed to describe this symptom-complex, and included such terms as chronic sinusitis associated with cough, mediastinal lymphadenopathy, hilar and mediastinal lymphadenitis, nasopharyngeal lymphatic ring, chronic nonspecific cough in children, nasopharyngeal and mediastinal lymphoid hypertrophy, and catarrhal deafness associated with nasopharyngeal lymphoid hyperplasia. In fact, in the system, "Therapeutics of Infancy and Childhood" published in 1942, one of us (S.G.S.[13]) describes in detail the spectacular results obtained with roentgen therapy in "chronic non-specific cough in children," in "naso-pharyngeal lymphoid hyperplasias," and in "chronic sinusitis." A critical review of the histories of these patients reveals that many of the cases reported under the various diagnostic categories described above would probably be considered as sinobronchitis today. Incidentally, it is interesting to note that the term, sinobronchitis, has been coined only recently. Some clinicians prefer to use the term, sinobronchial syndrome. This presentation represents both a clinical and technical analysis of 168 cases of sinobronchitis in children treated with roentgen rays.

DEFINITION

Sinobronchitis or sinobronchial syndrome may be defined as a subacute or chronic infectious process involving the mucosa of the paranasal sinuses, with secondary implantation of the infection upon the mucous membrane of the bronchi through postnasal drainage, and with subsequent production of hilar infiltration and focal pulmonary lymphadenopathy. The degree of involvement of the sinuses or of the chest varies with the individual case. The sinuses may be markedly involved, with but moderate or slight accompanying chest pathology, or, conversely, the sinuses may be but slightly involved, yet the hilar infiltration and the focal lymphadenopathy may be very pronounced. In addition, there are cases which show marked involvement of both the sinuses and the chest.

CLINICAL ASPECTS

In our series of 168 cases, there were 88 females and 80 males, so that sex plays no significant role. The *age incidence* varies, the infection being most prevalent in the age period between four and seven years (78, or 47 per cent, of our series). Our youngest patient was thirteen months old and we had 8 patients under two years of age. Sixty-three patients were under five years of age, 73 were between five and ten, and 29 were between eleven and fifteen.

The onset of the illness is frequently insidious. Some of these patients run a protracted, low grade, and apparently unexplained fever. Others have frequent attacks of upper respiratory infections, some of which may be associated with high temperatures. Occasionally headache, usually frontal in type, is the chief complaint. As time goes on, many of these children develop hyperplasia of the lymphoid tissue in the nasopharynx and the pharynx, and a few may complain of a partial loss of hearing. As the pulmonary

complex develops, these children usually acquire a severe protracted cough, which is spasmodic in nature, worse at night and in the early morning hours, and which fails to respond to medication. Not infrequently some of these patients have repeated nocturnal attacks of hoarseness and even croup. Table I illustrates the predominating complaint in our series of patients. It is to be noted that most of our patients fall into the category either of frequent upper respiratory infections (66, or 39 per cent) or of protracted cough (67, or 40 per cent). This does not mean that only 39 per cent of our patients had repeated upper respiratory infections or that only 40 per cent had a protracted cough. Most of our patients had more than one complaint. For example, cough was one of the complaints in 90 per cent of our patients, though it was the chief complaint in only 40 per cent. There were 19 patients, or 11 per cent, with protracted, low grade fever; 7 patients, or 4 per cent, complained of headache; 4, or approximately 3 per cent, suffered from deafness; and 5, or 3 per cent, had hoarseness and croup.

As to the *duration of symptoms*, an analysis of our cases clearly demonstrates that the older the child, the longer have the symptoms persisted (Table II). It is interesting to note that the average duration of symptoms in the age group of eleven to fifteen years was four times greater than in the age group of one to five years. The significance of this differential will be discussed under treatment.

Physical examination of these patients reveals a paucity of findings. Usually one does not elicit any tenderness over the sinuses. Transillumination is occasionally helpful in detecting an infected sinus, but this is not a very reliable procedure in children. Careful rhinological examination frequently reveals a purulent discharge at the ostia of the infected sinuses. The mucous membrane may be edematous and congested and the turbinates may be hypertrophied. The pharynx is usually chronically inflamed and may have a granular appearance due to swelling and redness of the lymph follicles. The hypertrophied lymphoid tissue has a characteristic appearance. A postnasal drip of purulent material is a common finding. The chest is usually clear to routine physical examination with the exception of those cases presenting a complicating asthmatic bronchitis.

Table I

PREDOMINATING COMPLAINT IN 168 CASES OF SINOBRONCHITIS

1. Frequent colds	66, or 39%
2. Protracted cough	67, or 40%
3. Protracted, low grade fever	19, or 11%
4. Headache	7, or 4%
5. Deafness	4, or 3%
6. Frequent attacks of nocturnal hoarseness and croup	5, or 3%

PATHOLOGY

Subacute or chronic inflammatory changes permeate the mucous membrane of the sinuses, the nasal passages, the nasopharynx, the pharnyx, and the bronchi. The mucous membrane of the larynx and trachea may also be affected and this accounts for the nocturnal attacks of hoarseness and the croupy seizures in some of these children. Harper[6] examined the tissues of the infected sinuses histopathologically. He found a variety of pathological changes, including isolated small abscesses in the mucosa, small polyps, fibrosis of the deeper layers, thinning of the bony walls, and a deep infiltration of virulent bacteria. The bacteriology of the sputum and the

Table II

DURATION OF SYMPTOMS

Age Group in Years	No. of Cases	Average Duration in Years
1– 5	66	1.5
6–10	73	2.3
11–15	29	6.5
TOTAL	168	3.4

secretions of the nose and throat are not specific. Staphylococci, streptococci, hemolytic or non-hemolytic, and pneumococci usually predominate, though *H. influenza*, *B. coli*, and many organisms are found. The blood count is usually normal though occasionally a moderate leukocytosis is observed. The blood sedimentation rate is sometimes rapid, especially in those cases associated with fever.

ROENTGEN FINDINGS AND DIAGNOSIS

The diagnosis is definitely established by a proper and painstaking roentgenologic examination. For the sinuses a frontal view is obtained with the nose and forehead on a Potter-Bucky diaphragm elevated to a 22 degree angle. The Waters position with the nose-chin on the diaphragm and the mouth wide open demonstrates the antra and sphenoids, as the first position reveals the frontal and ethmoidal sinuses. The lateral views complete the routine demonstration of the sinuses.

The chest is portrayed in the postero-anterior projection as well as in the lateral view, preferably at a 6 foot target-film distance. The lateral projection is all important to demonstrate the presence of lymphadenopathy at the bifurcation of the trachea as well as in front of and behind the trachea. Immobilization of the patient is most important for the proper interpretation of the shadows. In very young subjects, rapid exposures are essential to avoid movement which blurs the roentgen image.

The roentgen findings demonstrate a haze or an opacity in one or more of the accessory nasal sinuses which sometimes appear completely opaque. A faint haze as compared with a normal sinus on the opposite side is often discernible and indicates involvement. A thickened mucous membrane is frequently demonstrated on the roentgenograms of the sinuses, particularly in the antra, where the thickness may measure from $\frac{1}{4}$ to $\frac{1}{2}$ inch. In the chest considerable hilar and mediastinal lymphadenopathy is revealed, especially at or near the bifurcation of the trachea, and is best demonstrable in the lateral roentgenograms. The nodes may be single but are usually conglomerate. Their borders are fuzzy and generally they show no calcification within their density. The lumen of the trachea and major bronchus may be narrowed at the points of compression by these enlarged glands. The tracheal bifurcation is often displaced laterally and somewhat elevated and at times is almost obscured by the glandular shadows.

An enlarged or a persistent thymus can readily be excluded from the diagnosis, because in thymic metaplasia there is a broadening of the superior mediastinum and an opacity in the anterior mediastinum which shows normal clarity in sinobronchitis. Since the history of many patients is long standing, certainly of several months and frequently of several years' duration, the absence of calcification in the mediastinal lymph nodes tends to rule out an underlying tuberculous infection. Should there be some calcific shadows in the lymph node hyperplasia of the posterior mediastinum, the process is not necessarily an active case of childhood tuberculosis and is no contraindication to roentgen therapy.

COMPLICATIONS

There is no doubt that a certain number of children with sinobronchitis, if left alone, eventually make a spontaneous recovery. It is very difficult to estimate with any degree of accuracy the percentage of such cases. Conversely, we do know that many of these children develop undesirable complications. Many of these patients go into a chronic, irreversible state. Crowe, Burman and Baylor[2,3] state that some of these children eventually develop deafness. They believe that many of the hearing disorders in adult life are traceable to childhood. The overgrowth of lymphoid tissue in the nasopharynx may partially obstruct the eustachian tubes and may cause changes in the mucous membrane of the middle ear. Eventually fibrous tissue is formed which interferes more and more with the mobility of the ossicles. On otoscopic examination, the first evidence to be seen in the tympanic membrane is usually retraction of

Shrapnell's membrane. The impairment at first is for high tones with the hearing usually good for low tones. Unless adequate measures are taken early to combat this condition, the deafness may be chronic and progressive. In our series of cases, we had 4 children with a partial loss of hearing.

Bronchiectasis is frequently reported in the literature as a complication of sinobronchitis, particularly when the ethmoids are involved. This is stressed by Lacharite[10] in Canada, by Dutton and Fuchlow,[4] and some of our patients to Florida, Arizona, and California for extended stays with only transitory beneficial results. Perhaps the answer to the question of climate as a therapeutic measure can be found in the following report: Laing,[11] in Pasadena, California, treated 900 children with subacute sinusitis with roentgen therapy. Many of these patients had pulmonary complications. This represents a large number of cases for one worker, and one can readily assume that the reason for such a

Table III

DIFFERENTIAL DIAGNOSIS (AFTER DUTTON AND FUCHLOW)[4]

	Asthma Due to Atopy	Asthma Due to Sinobronchial Syndrome
1. Onset	Sudden (allergic history: eczema, hay fever, etc.)	Gradual and associated with acute exacerbation of sinobronchitis
2. Duration	Paroxysmal, short duration	Gradually developing, longer duration
3. Response to adrenalin	Good	Poor
4. Fever	Not usual	Usual
5. Leukocytosis	Infrequent	Usual
6. Sedimentation rate	Very slow	Normal or rapid
7. Nasal smears	Eosinophilic	Neutrophilic
8. Bacteriology	Usually indifferent	Usually streptococci, staphylococci, pneumococci
9. Roentgen findings in chest and sinuses	Minimal changes	Striking changes
10. Seasonal changes	Not seasonal or corresponding to pollen season	Winter or sudden changes in weather

Hagens, Karp and Farmer[5] in America, and by several foreign authors. A fourth complication described by Dutton and Fuchlow is asthma due directly to the sinobronchial infection. They make a sharp differentiation between this type of asthma and atopic asthma, constructing a table which demonstrates the differential diagnosis between these two types of asthma (Table III). In our series of 168 cases of sinobronchitis, 28, or 17 per cent, showed a complicating allergy. Nineteen of these patients had a bronchial asthma, but most of these cases were definitely established as being atopic in character.

TREATMENT

Experience does not bear out the popular concept that change of climate will benefit patients with sinobronchitis. We have sent great concentration of cases in that locality is that they were sent there on the advice of their physicians. The fact that they eventually had to be subjected to roentgen therapy does not attest to the efficacy of solar therapy in California as a modality in the treatment of sinobronchitis in children.

One of us (M. S.) has treated a small group of patients with sinobronchitis with generalized exposure to ultraviolet rays. After a prolonged course of treatment it was found that this procedure resulted in no improvement either in the symptoms or in the roentgenologic appearance of the sinuses and the chest.

Both Hunnicutt[9] and Hilton[8] stress the fact that a long standing, chronic sinobronchitis will clear up frequently in spectacular fashion when diseased tonsils and

adenoids are removed. In our series of cases, with the exception of a few infants, all of our patients have had a tonsillectomy and adenoidectomy prior to the onset of their symptoms of the sinobronchial syndrome.

Hunnicutt,[9] Dutton and Fuchlow,[4] and many others, report that nasal drops and sprays have very little beneficial effect in these cases. Autogenous vaccines were found to be valueless. In contrast to the good results obtained with chemotherapy and antibiotics in acute sinusitis, they find this type of therapy disappointing and of questionable value in the treatment of sinobronchitis. A number of patients were treated with aerosol penicillin. Improvement was but temporary and relapse frequently followed shortly after cessation of treatment. Pons, Glass and Garthwaite[12] report somewhat better results when they employed aerosol penicillin under negative pressure in their treatment of chronic sinusitis in children with chronic pulmonary complications. The surgical treatment of the chronic sinusitis in these patients leaves much to be desired and is usually viewed with disfavor. In general, the fact that, in our series of 168 cases, the duration of symptoms in the age group of eleven to fifteen years was four times greater than in the age group of one to five years, does not attest to the efficacy of time or of medical and climatic treatment in the management of these cases.

ROENTGEN THERAPY

Lacharite[10] states that the rationale of treating sinusitis with roentgen rays was first established by Butler and Wooley in 1934. They demonstrated that the beneficial effects of roentgen irradiation even under small doses are due to the disintegration of the hypertrophied lymphoid elements of the hypertrophic membranes and the lymphocytes which liberate bacteriolysins, thus stimulating the macrophages to greater bactericidal activity. At the same time, the edema surrounding the ostia of the sinuses is reduced, thus promoting free drainage and aeration. Following roentgen treatment, destruction of the lymphocytes is observed on the second and third day. The macrocytes are later found loaded with debris and engulfed bacteria. The edematous membrane gradually decreases in thickness, and then fibrosis begins to appear. This fibrosis seems to be the result of the initial inflammatory process rather than the direct effect of the roentgen irradiation as no injury to the cilia, epithelium, and cellular elements is demonstrable after roentgen therapy.

The radiosensitivity of the inflammatory lymph nodes is universally known. The lymphocyte, being the most radioresponsive of all cells, is quickly destroyed with minimal exposures, and this fact accounts for the rapid disappearance of the hyperplastic lymphoid elements in the nose, nasopharynx, pharynx, hila, and mediastinum when roentgen therapy is employed. The leukocyte is also radiosensitive. As, the roentgen rays destroy the leukocytes, the latter liberate antibacterial elements which neutralize the inflammatory process and the infection.

TECHNIQUE OF ROENTGEN TREATMENT

To destroy the pathological condition in the paranasal sinuses, nasal passages and nasopharynx, it is necessary to irradiate the head so that these regions are included in the portals of entry. We use three portals for the head, an anterior and two lateral fields. The anterior portal is directed over the nose with the patient lying prone on the table and with either no cushion or a very thin cushion to prop up the head. The horizontal plane of the head should be parallel with the horizontal plane of the roentgen-ray cone. The upper border of the cone should take in the frontal sinuses and its lower border should reach just above the mouth or the carmine portion of the upper lip. The second portal is the right lateral; the head is turned completely to the left so that the horizontal plane of the right side of the face is parallel to the surface of the outlet of the roentgen-ray cone. The

cone just includes the external auditory canal and the nares from behind forward and the sphenoidal sinus and the base of the antrum from above downward. The sphenoidal sinus is located just below the imaginary line which connects the outer rim of the orbit with the external auditory canal. The base of the antrum is included when the cone reaches to a level just above the external commissure of the lips. Similarly, the third portal is treated which exposes the left lateral face and head. It may be more comfortable for the patient if his shoulder is propped up somewhat with a sandbag when irradiating the lateral portals in order to facilitate a good lateral position of the head. In the anterior portal, the cone is brought down to the tip of the nose; in the lateral fields, the cone is flush with the cheek and ear.

For most patients a 10 by 10 cm. cone is adequate to include the necessary regions in the field of irradiation; for younger subjects a 6 by 8 cm. cone is employed. The eyes are protected from the rays by being covered with two oval shaped pieces of lead rubber held in place by a narrow strip of adhesive. The lead rubber includes and protects the eyebrows but the bridge of the nose is exposed to the rays. The lead rubber protection for the eyes is used for all three portals. In treating the lateral fields, the hair is brushed away from the exposed rays as much as possible. Only rarely have we encountered some epilation at the temples; it was temporary in nature and a full growth of hair returned to the parts in three months.

Many of the younger subjects have to be immobilized on the table. We accomplish this by means of two broad compression bands attached to the therapy table. One band immobilizes the head, and the other, a slightly broader band, is locked taut across the abdomen and pelvis. We have never resorted to holding the child either by the parent or by our personnel. It is neither wise nor safe, nor can one obtain the perfect immobilization which is desirable by the use of an assistant. At most we allow one parent to sit beside the patient for the first or the first two treatments to reassure the child, after which time it is no longer required, as even an unruly child becomes confident of the innocuousness of the treatment.

The chest is treated through four portals, cross-firing the lymphadenopathy at the bifurcation of the trachea and the paratracheal regions through two anterior and two posterior fields. The cone is tilted toward the midline of the patient through each portal in order to avoid the lung beds as much as possible and in order to converge the rays on the enlarged glands. Occasionally, in very small subjects, we treat the chest through two portals, an anterior and a posterior field, allowing the rays to pass vertically through the chest. In these cases the cone is narrower than in the four portal technique, so that the lung beds are exposed to a minimal degree. In the four portal technique the cone measures 10 by 10 cm.; in the two portal technique it is 6 by 8 cm. The child is immobilized, if necessary, similarly as for the head treatments except that the head compression band is placed over the chest.

The average child receives 150 r, measured in air, to one portal three times a week for a total of twelve treatments, with the following technical factors: 180 kv. (peak), 50 cm. focal-skin distance, half-value layer 0.9 mm. Cu. The cone measures 10 by 10 cm. or 6 by 8 cm., depending on the size of the subject's head. Each portal receives four treatments or one treatment a week for four weeks, for a total of 600 r, measured in air, during the month. Occasionally, in younger patients or infants, a total of 450 r to each field is given. At the conclusion of the sinus treatments the cycle is continued by shifting to the chest, where each portal is given 200 r at a sitting, three treatments being given a week. We move to another field at each sitting until each portal has received three treatments for a total of 600 r, measured in air. These twelve treatments consume four weeks for administration. In infants for whom only

two portals are employed, one anterior and the other posterior over the bifurcation of the trachea, a total of from eight to ten treatments is given. In these patients a 6 by 8 cm. cone is used as compared with a 10 by 10 cm. cone employed with the other patients. The same technical factors are used as in the treatment of the sinuses.

In from four to six weeks after the completion of the irradiation, the sinuses and the chest are roentgenographed again. Exactly the same positions and technique are employed as in the initial examination. These roentgenograms are carefully compared with those which were taken before radiotherapy. The roentgenographic progress of the patient can thus be determined with a fair degree of accuracy.

TABLE IV

RESULTS OF ROENTGEN THERAPY

	Complete Recovery	Markedly Improved	Moderately Improved	Slightly Improved
No. patients	98 (58%)	47 (28%)	18 (11%)	5 (3%)

RESULTS OF ROENTGEN THERAPY

Lacharite,[10] Bowman,[1] and many others, have reported excellent results in the treatment of sinobronchitis with roentgen rays. Laing,[11] in his series, reported cures in 71 per cent of his cases, moderate improvement in 15 per cent, and slight improvement in 14 per cent. With a second course of treatment, over half of the cases showing improvement were cured. Dutton and Fuchlow[4] have treated their children with asthma due to sinobronchitis with roentgen rays, and their results were very gratifying.

In evaluating our results of roentgen therapy for sinobronchitis, we have established the following criteria. A patient was considered to have fully recovered when all the symptoms had subsided, when the physical signs in the nose and throat had disappeared, and when the roentgenograms of the sinuses and the chest showed clearing of the infection. Those patients whose symptoms and physical findings had cleared but whose roentgenograms still showed slight residual pathology, either in the sinuses or in the chest, were considered markedly improved. When, after treatment, patients still presented residual symptoms, such as cough or the tendency to repeated upper respiratory infections, or some physical sign remained, such as a postnasal drip, even though there was almost complete clearing of the infection in the sinuses and the chest roentgenologically, they were considered as moderately improved. When both the clinical and roentgenographic evidence of the infection was somewhat improved but still present, such patients were considered as showing a slight improvement.

Employing these criteria to measure the results of treatment, we found that, in our series of 168 patients treated by irradiation, 98, or 58 per cent, had fully recovered; 47, or 28 per cent, showed marked improvement; 18, or 11 per cent, showed moderate improvement; and 5, or 3 per cent, showed slight improvement (Table IV). It is interesting to note that not a single patient receiving treatment failed to show some degree of improvement.

No untoward effect of any serious nature was encountered during the administration of therapy or in our follow-up. This is to be expected since the dosage employed is far removed from carcinolytic exposures which reach erythematous limits. The technique is similar to the small dosage employed for inflammatory and infectious processes and the dosage represents only a small fraction of an erythema.

Some children experienced a faint flush a few hours after the sinuses were exposed to the roentgen rays. This usually occurs in children of fair complexion. This flush should not be mistaken for a skin erythema. It disappears in a few hours and is no contraindication to the continuation of treatment. After a number of treatments to the sinuses, a congestion of the nose sometimes appears, varying in degree with the individual. In a few older children a gradual loss of the sense of taste was noted. These symptoms were very transitory and did not

contraindicate the completion of treatment. Four children in our series developed a slight epilation at the temples. This was temporary in nature and the regrowth of hair was complete within three months in all 4 patients. Towards the end of the series of treatments to the sinuses, a few patients complained of headache or pain between the eyes. The headache and pain were transitory in nature and disappeared completely within a few days.

We have not experienced any injury to the bone, brain, eye, lung, or other organs as the result of therapy. The eyes are well shielded with heavy lead rubber. The pituitary gland is well outside of the exposed fields, as in the lateral portals the upper margin of the cone is set just below the sella turcica. When treating the hilar glands and mediastinal lymphadenopathy, the cone is directed from without inward toward the midline to avoid as much lung parenchyma as possible. With this technique the possibility of postirradiation fibrosis becomes remote. There are a few anxious individuals who still consider the possibility of sterility arising as the result of roentgen therapy for sinobronchitis. This is mentioned only because such an unfounded fear may result in denying these children a form of treatment that is both harmless and gratifyingly effective.

As a rule, in about two weeks after the completion of therapy to the sinuses, the nasal discharge and the postnasal drip disappear. The nasal mucosa loses its congested and edematous appearance and the turbinates are smaller. The mucous membrane of the pharynx is no longer granular but now assumes a normal appearance. Headache, if present, is completely relieved. The cough may stop even before the therapy to the chest has been completed.

Our poorest results were obtained in those cases presenting a complicating allergy. This type of case represented 17 per cent of our series. Henderson[7] states that an underlying allergy is perhaps the most important factor in those cases giving unsatisfactory results and is responsible for recurrences of infections. We have found that when this type of case was treated simultaneously by the roentgenologist and the allergist, better results were obtained.

REPORT OF CASES

Case 1. L. L., a female, aged eight, had developed a severe spasmodic cough in the fall of 1948. The cough was worse at night and in the early morning hours and persisted in spite of adequate treatment with chemotherapy, antibiotics, and a large variety of cough mixtures. She had had her tonsils and adenoids removed in 1945. She was first seen by us six months after the onset of her symptoms. At that time she did not appear acutely ill. There was slight tenderness over both maxillary sinuses which transilluminated poorly. The mucous membrane about the turbinates and the ostia of the sinus was edematous, congested, and swollen with a purulent discharge emanating from these points. There was a postnasal drip of thick, tenacious, purulent material and lymphoid hypertrophy in the pharynx. Hearing was normal. The chest was essentially negative to physical examination. The blood count and sedimentation rate were within normal limits, and the tuberculin test was negative.

Roentgenologic examination of the sinuses showed both ethmoidal sinuses to be opaque, the density being more pronounced on the right than on the left side. Both antra and both sphenoids were cloudy, due to a markedly thickened mucous membrane which measured $\frac{5}{8}$ inch in its thickest portion. The chest films revealed considerable hilar infiltration bilaterally and marked lymphadenopathy at the bifurcation of the trachea which was encroached upon and elevated by the enlarged glands (Fig. 1*A* and 1*B*).

After the completion of a course of roentgen therapy, the patient ceased to cough and the pus in the nares and the postnasal drip disappeared. The mucous membrane of the nose and of the pharynx now presented a normal appearance. A follow-up roentgenologic examination four weeks later revealed a complete reaeration of both ethmoidal sinuses, both antra, and both sphenoidal air cells with a total disappearance of the thickening of the antral and sphenoidal mucosa. The glandular hyperplasia was markedly reduced at both hila and at the bifurcation of the trachea which appeared clear and of normal caliber. The eleva-

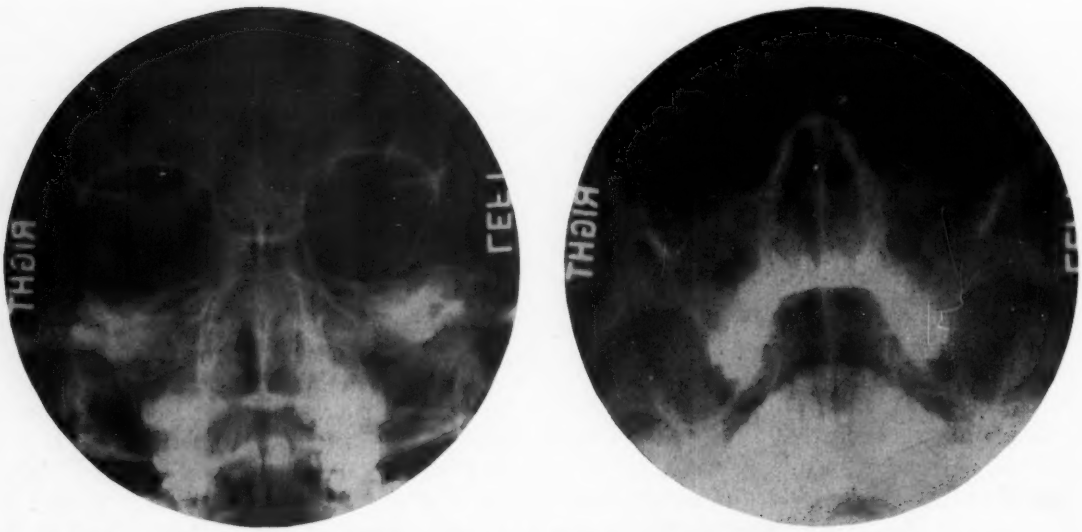

FIG. 1*A*. Case I. Note the opacity of both ethmoids. Both antra and sphenoids are also cloudy, due to a markedly thickened mucous membrane.

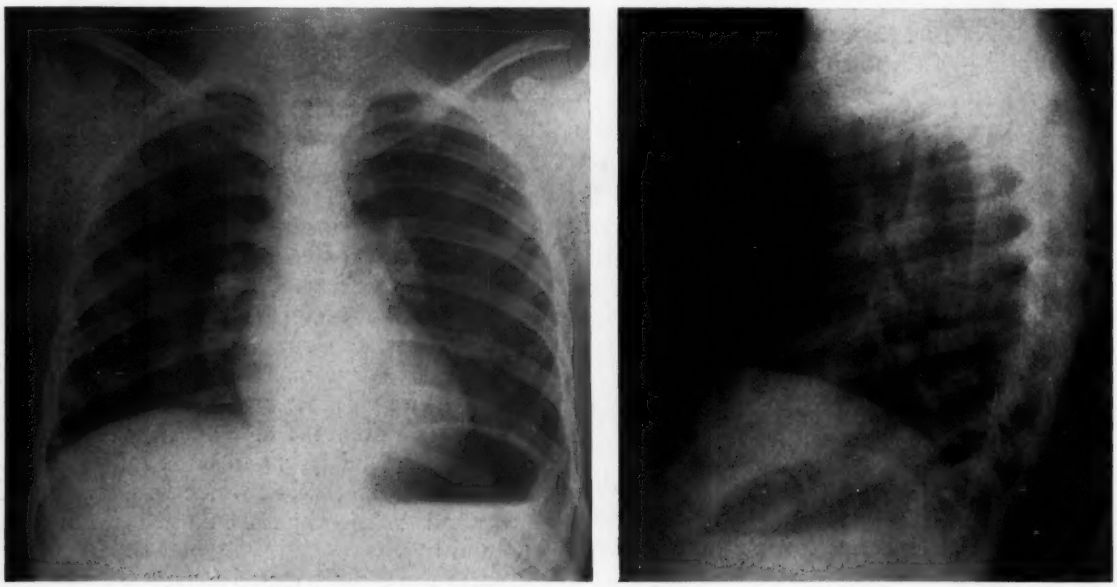

FIG. 1*B*. Case I. Chest reveals a pronounced hilar infiltration and there is marked lymphadenopathy at the bifurcation of the trachea which is encroached upon and elevated by the enlarged glands (before roentgen treatments).

tion of the bifurcation of the trachea was no longer noted (Fig. 1*C* and 1*D*).

CASE II. B.A., a girl, aged four and a half years, was having frequent upper respiratory infections associated with high fever for a period of one year. During the past three months she developed a severe, protracted cough which was worse at night and in the early morning hours. Although she had received adequate chemotherapy and antibiotics with each attack of infection, and was given a variety of cough mixtures and antispasmodics, the symptoms continued unabated. During the past two months her mother noted a gradual increasing impairment of hearing. She had her tonsils and adenoids removed just prior to the

onset of her illness. Physical examination revealed pus in both nares and a purulent postnasal drip. The pharynx was congested and the lymph follicles were hypertrophied as evidenced by a coarsely granular appearance of the mucosa. The chest was essentially negative to physical examination. The blood count and sedimentation rate were within normal limits. The tuberculin test was negative.

Roentgenograms of the sinuses revealed a density of the left ethmoidal sinus and a thickening of the lining of the right. Both antra were hazy due to an irregular thickening of the mucous membrane. In the chest, the right hilar

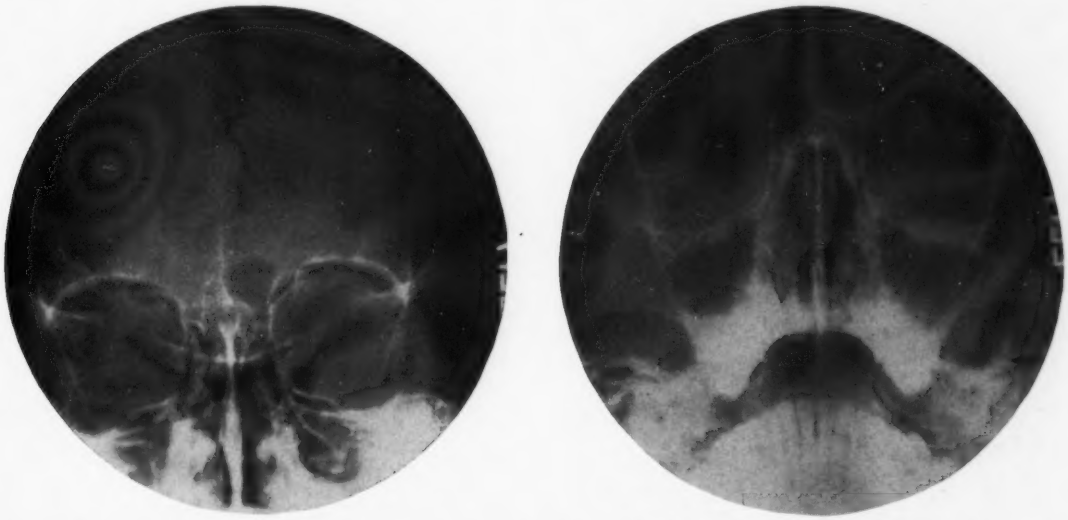

Fig. 1*C*. Case 1. Four weeks after roentgen therapy the ethmoidal sinuses are reaerated and both antra and sphenoids are now clear, with a total disappearance of the thickened mucous membrane.

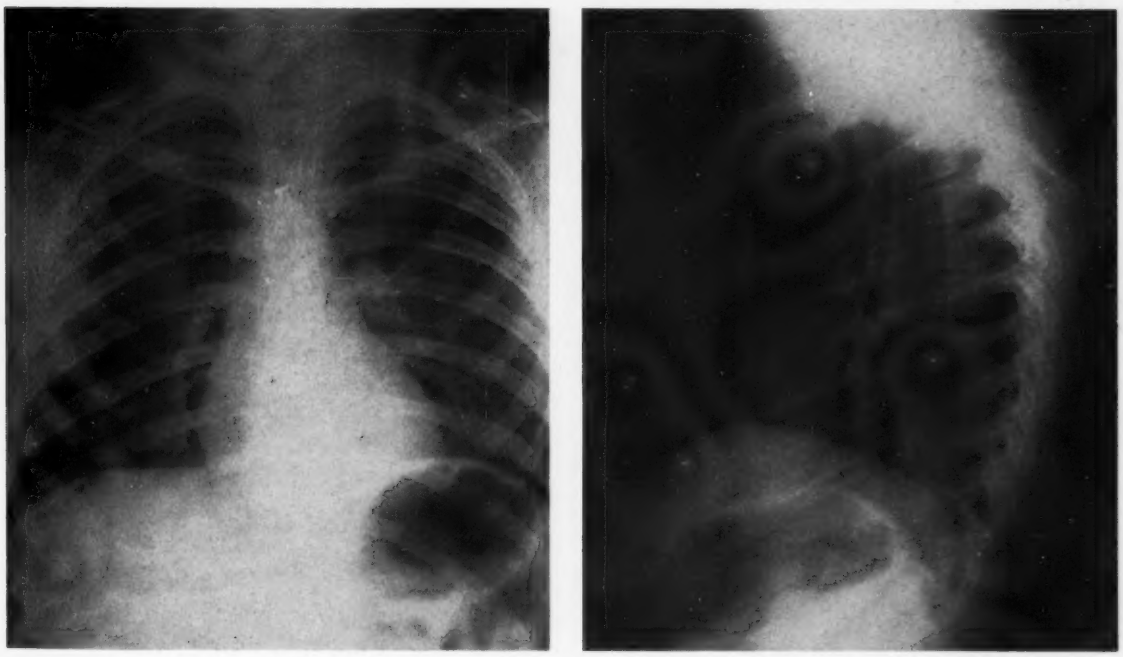

Fig. 1*D*. Case 1. The chest now shows a reduction of the glandular hyperplasia both at the hila and, as observed in the lateral view, at the bifurcation of the trachea which now appears clear and of normal caliber. The elevation of the trachea is no longer noted (four weeks after therapy).

markings were pronounced and its perivascular tree was thickened, especially at the mesial portion of the base of the right lung. In the lateral view, larger and smaller glands were demonstrable in front of, behind, and below the bifurcation of the trachea (Fig. 2*A* and 2*B*).

After a series of roentgen treatments to the sinuses and chest, the girl had ceased to cough and the pus in the nares and the postnasal drip disappeared. The pharynx assumed a normal appearance. The follow-up roentgen study showed a resolution of the thickened mucosa of the right ethmoid and a reaeration of the left ethmoidal cells. Normal clarity was observed in both antra with complete absorption of the thickened mucosa. The right hilus was normal in appearance, and the thickening of the perivascular tree in the lower mesial portion of the right lung was resolved. The glandular

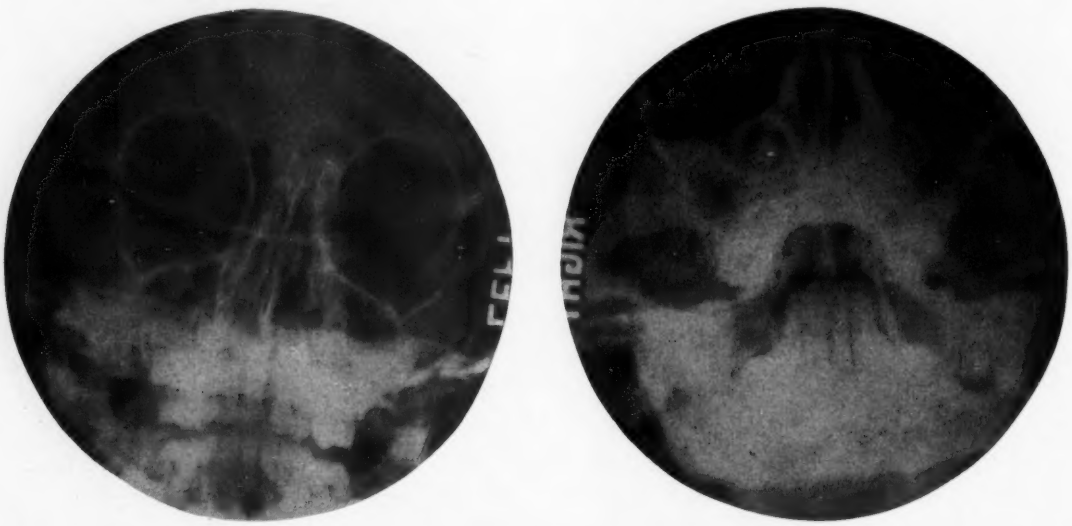

FIG. 2*A*. Case II. There is a density of the left ethmoidal sinus and a thickening of the lining membrane of the right. Both antra are hazy.

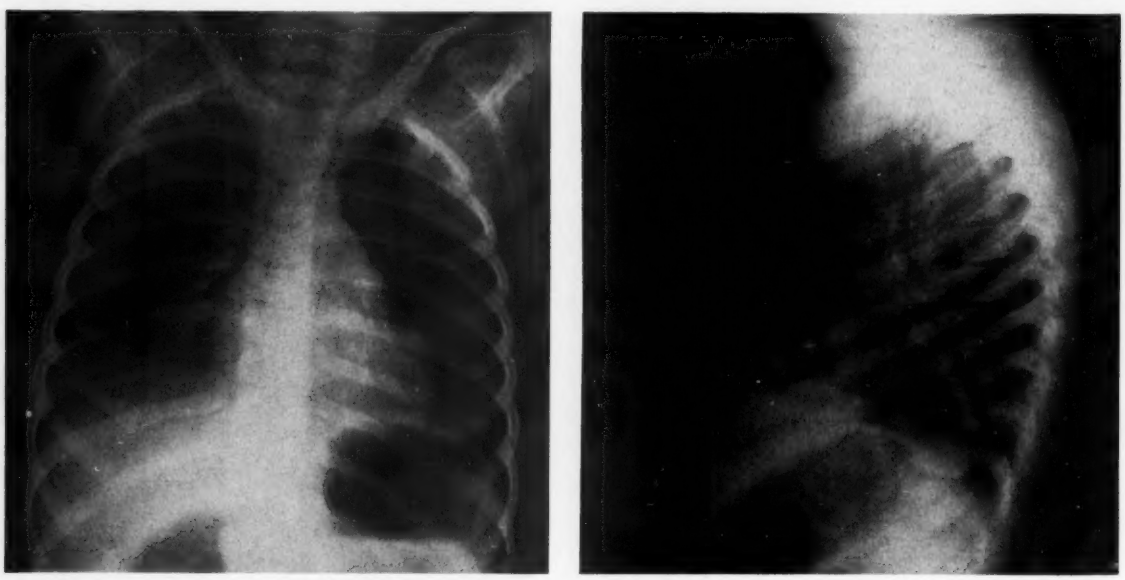

FIG. 2*B*. Case II. Observe the pronounced right hilar markings with thickening of the perivascular tree, especially at the lower mesial portion of the right lung before roentgen therapy. In the lateral projection note the smaller and larger glands in front of, behind, and below the tracheal bifurcation.

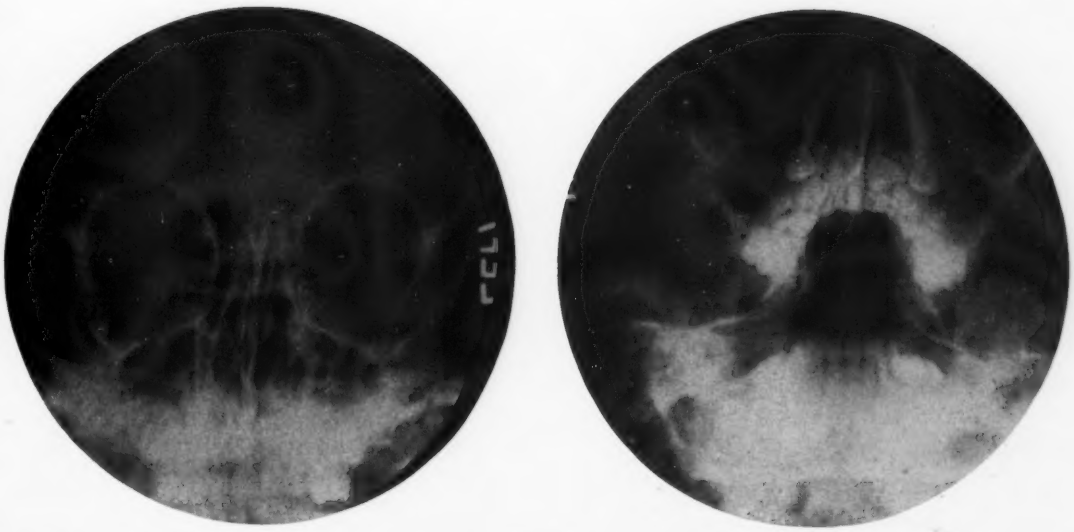

Fig. 2*C*. Case II. After roentgen therapy absorption of the thickened mucous membrane of the right ethmoidal and reaeration of the left ethmoidal sinus are observed. Both antra are now clear.

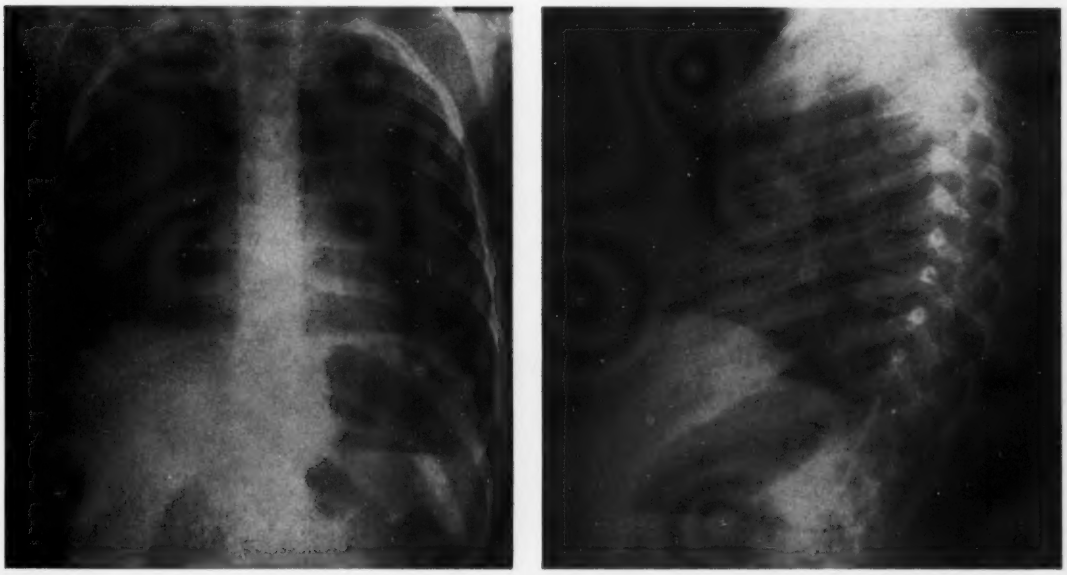

Fig. 2*D*. Case II. After treatment the right hilus appears normal and the thickening of the perivascular tree in the lower right lung bed is resolved. In the lateral projection the glandular shadows about the trachea and its bifurcation in most part have disappeared.

shadows about the trachea and its bifurcation had disappeared (Fig. 2*C* and 2*D*).

Case III. J. E., a male, aged eleven, complained of a "stuffed" nose for a period of eight months, associated with irregular attacks of fever of 101 to 103° F., lasting from one to three days and occurring at almost weekly intervals, for which he received adequate amounts of penicillin and sulfadiazine. In the past three months he developed a severe cough. When first seen he appeared tired and listless, which was attributed by the parents to his disturbed sleep as a result of the persistent cough. Examination revealed pus in the left nostril and a purulent postnasal drip. The pharynx was deeply injected and the lymph follicles were prominent. The chest was essentially negative to physical examination. A blood count showed

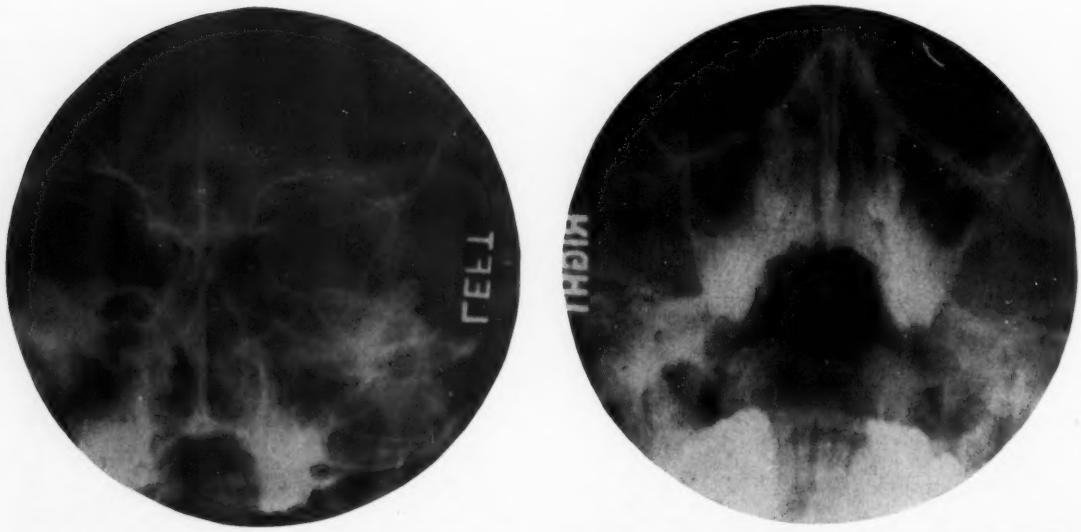

FIG. 3*A*. Case III. There is a slight haze over the right frontal sinus and an opacity of the right ethmoidal cells. Both antra are slightly cloudy and the right shows a thickened lining membrane at the base and lateral walls.

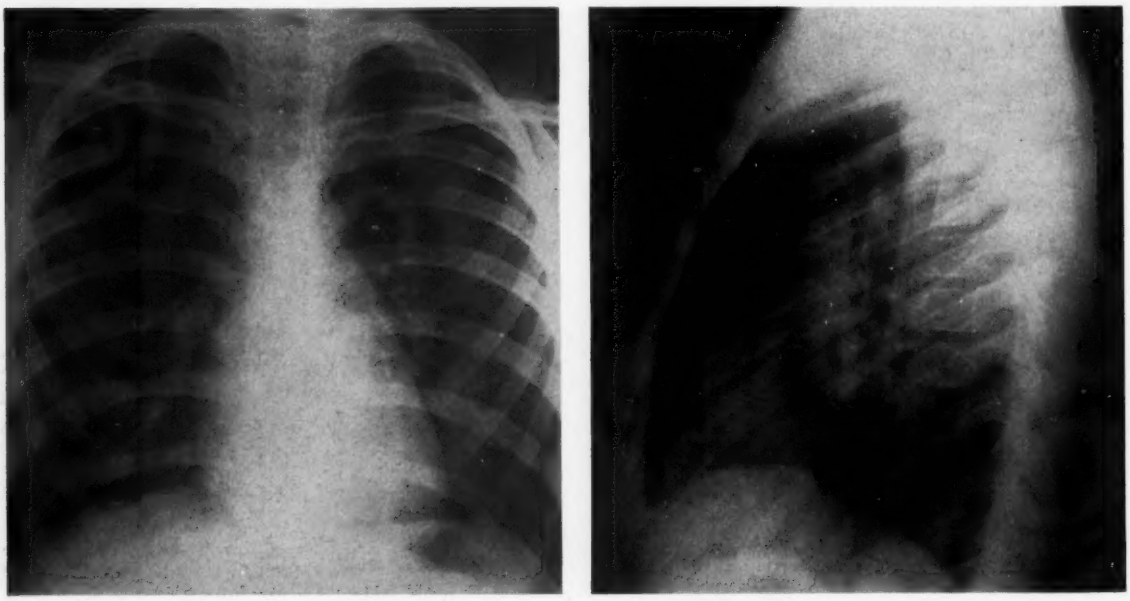

FIG. 3*B*. Case III. Before roentgen treatment, one can demonstrate increased hilar infiltration and, in the lateral view, moderate lymphadenopathy obscuring the lower trachea and its bifurcation.

a moderate leukocytosis and the sedimentation rate was rapid (45 mm. per hour; corrected normal reading, 18 mm. per hour). The tuberculin test was negative.

Roentgenologically, there was a light haze over the right frontal sinus, the right ethmoidal cells were opaque, and both antra appeared hazy, the left revealing a thickened mucosal lining at the base and lateral walls. Increased bilateral hilar infiltration and a moderate lymphadenopathy in the posterior mediastinum which obscured the lower trachea and its bifurcation were demonstrated in the films. A large opaque lymph nodule resting on the posterior wall of the upper portion of the thoracic trachea was clearly observed in the lateral

roentgenogram (Fig. 3*A* and 3*B*).

At the termination of the roentgen therapy, the patient's cough disappeared and his sleep was sound. The pus in the left nostril and the postnasal drip disappeared. The pharynx appeared normal. The blood count returned to normal limits and the sedimentation rate dropped to 10 mm. per hour. There were no further episodes of fever. A follow-up roentgen study revealed normal clarity in the right frontal and right ethmoidal sinuses. There was complete aeration of both antra and the mucous membrane shrunk to normal. The hilar glands resolved and a normal tracheal shadow with its bifurcation appeared in the roentgenograms. The large lymph nodule on the upper posterior tracheal wall disappeared (Fig. 3*C* and 3*D*).

Case iv. R. F., male, aged seven, had a severe protracted, spasmodic cough for three

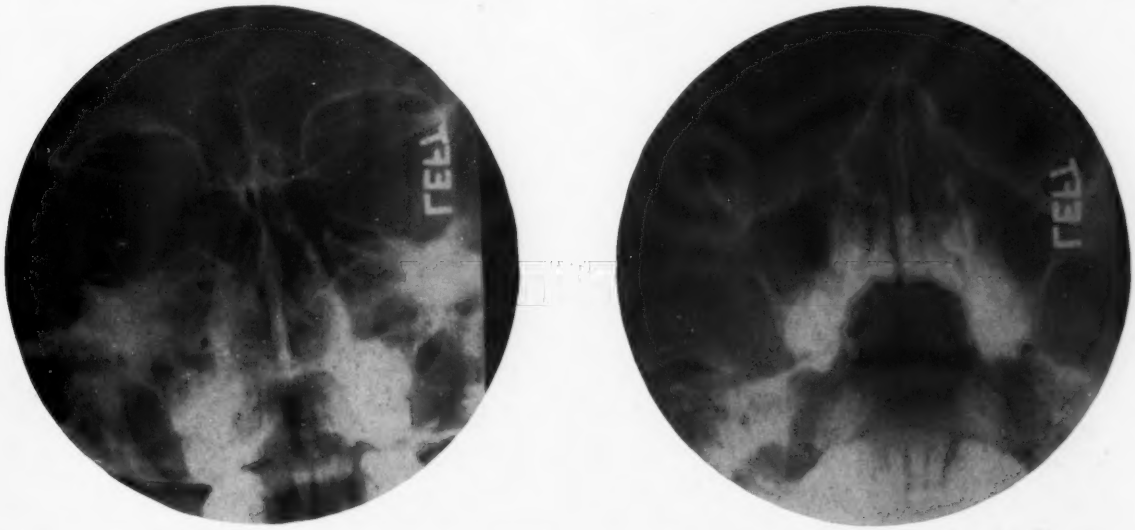

Fig. 3*C*. Case iii. After irradiation normal clarity has returned to the right frontal and the right ethmoida sinuses. Both antra are now completely aerated and the thickened lining membrane of the left antrum has shrunken considerably.

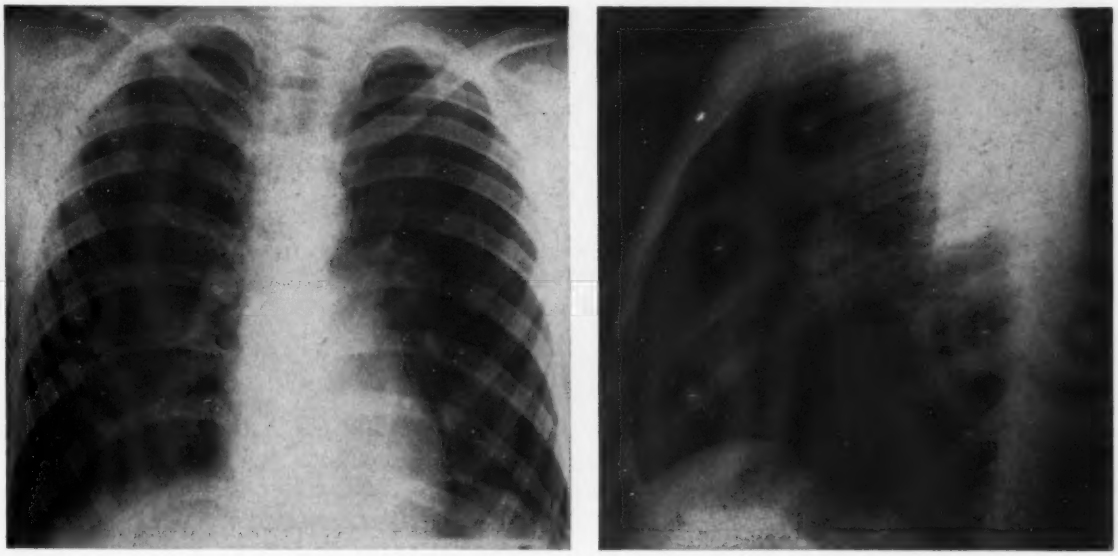

Fig. 3*D*. Case iii. Postirradiation roentgenograms show a resolution of most of the hilar and mediastinal nodes with a reappearance of the normal outline of the trachea and its bifurcation.

years. The cough was present both winter and summer and was not relieved by medicaments. He spent a winter in Florida without any symptomatic abatement. The following winter was spent in Arizona with equally disappointing results. Examination disclosed pus in the right nostril. The right inferior and middle turbinates were swollen. There was a purulent postnasal drip. The lymphoid follicles in the pharynx were markedly hypertrophied. The child's hearing was good. The chest was negative to physical examination. The blood count and sedimentation rate were within normal limits. The tuberculin test was negative.

Roentgenologic examination of the sinuses and chest showed the right ethmoidal sinus to be opaque. A density was present in the right antrum due to a thickened mucous membrane which obscured almost the entire antral space except for a small triangular translucency in its

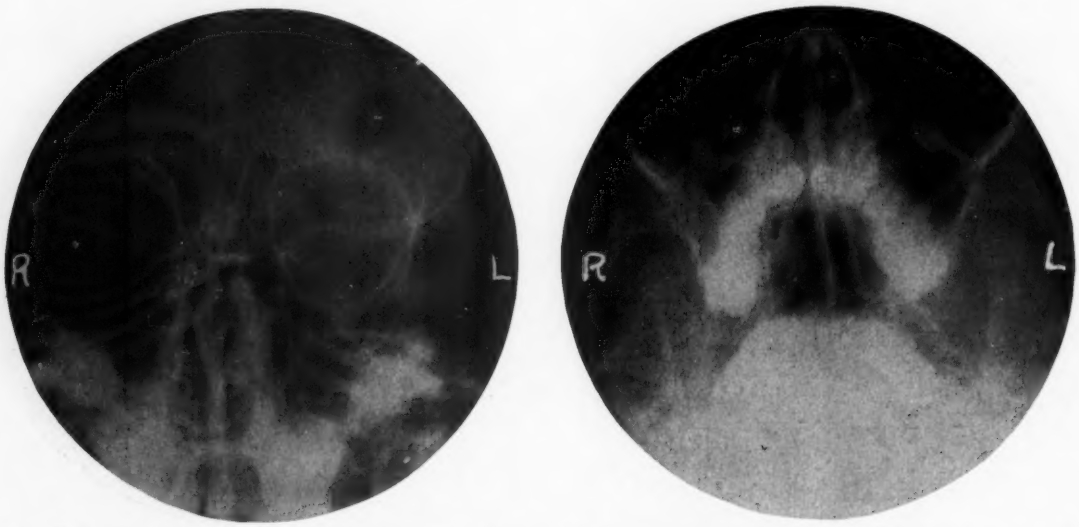

FIG. 4*A*. Case IV. The right ethmoidal sinus is opaque. A density is present in the right antrum due to a thickened mucous membrane which obscures almost the entire antral space. Both sphenoidal air spaces are similarly affected with a thickened mucosa, the right more so than the left.

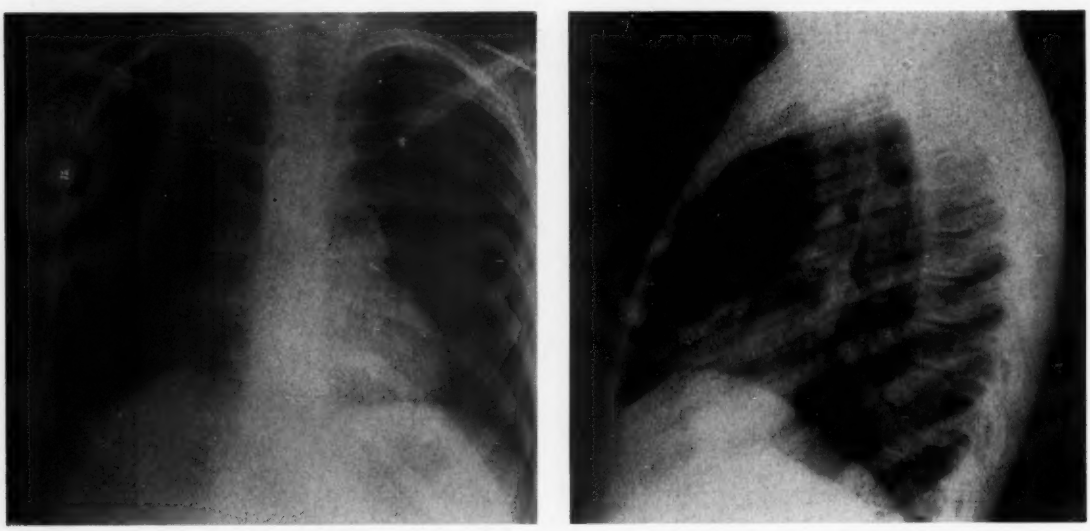

FIG. 4*B*. Case IV. At the onset of treatment, the infiltration in the hila is more pronounced on the right side than on the left. Considerable lymphoid hyperplasia is demonstrable in the mid-posterior mediastinum. This mass of glands lies in front of and posterior to the lower trachea and at its bifurcation. It narrows the left primary bronchus to one-half of its normal caliber.

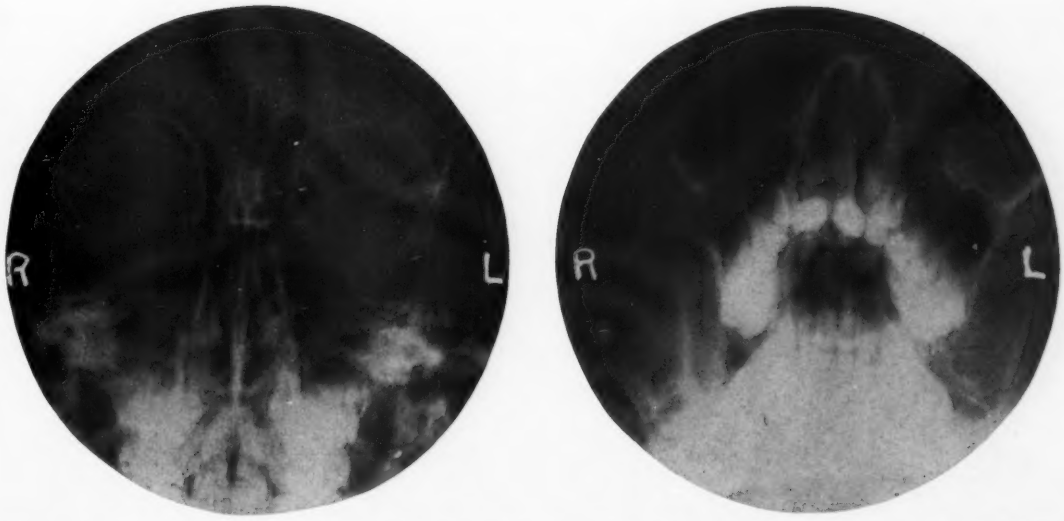

Fig. 4*C*. Case iv. Four weeks after completion of treatment, the right ethmoid is reaerated. The thickened mucous membrane in the right antrum and both sphenoids have also completely resolved.

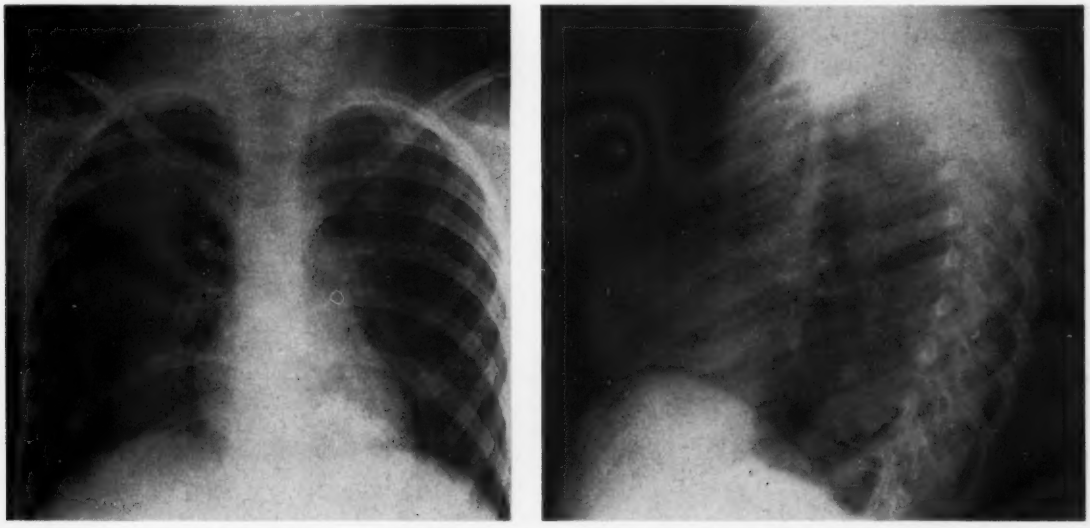

Fig. 4*D*. Case iv. The pronounced enlargement of the lymph glands has resolved after irradiation and the hilar density has returned to normal. The left primary bronchus now assumes its normal appearance without being encroached upon by swollen lymph nodes.

central portion. The infiltration in the hila was more pronounced on the right side than on the left. Considerable lymphoid hyperplasia was demonstrable in the mid-posterior mediastinum. This mass of glands lay in front of and posterior to the lower trachea and at its bifurcation. It narrowed the left primary bronchus to one-half its normal caliber (Fig. 4*A* and 4*B*).

After irradiation of the sinuses and chest, the cough, the discharge from the right nares, and the postnasal drip disappeared. The pharynx showed a pale pink color with a disappearance of the red, hypertrophied lymphoid elements. Follow-up roentgen study revealed a complete resolution of the infiltrative products of the right ethmoidal sinus and a total reaeration of the antra. The pronounced increase of the lymph glands resolved and the hilar density returned to normal (Fig. 4*C* and 4*D*). Observed clinically for four years this patient has had no evidence of recurrence of the infection.

Case v. H. N., female, aged six, gave a history of frequent attacks of asthmatic bronchitis

since the age of two years. For the past year she has been having frequent attacks of fever. In the last three months she has developed a persistent spasmodic cough which failed to respond to medication. Physical examination showed a pale and edematous nasal mucosa and swollen turbinates. Pus was seen deep in the nasal passages. Upon examination of the throat and nasopharynx, a purulent postnasal drip was present and the lymph follicles were markedly hypertrophied. No auditory disturbance was noted. The chest was negative to physical examination. The blood count showed a slight leukocytosis with 5 per cent eosinophils. The sedimentation rate was within normal limits. A nasal smear showed an abundance of eosinophils. The tuberculin test was negative.

The sinuses and chest, studied roentgeno-

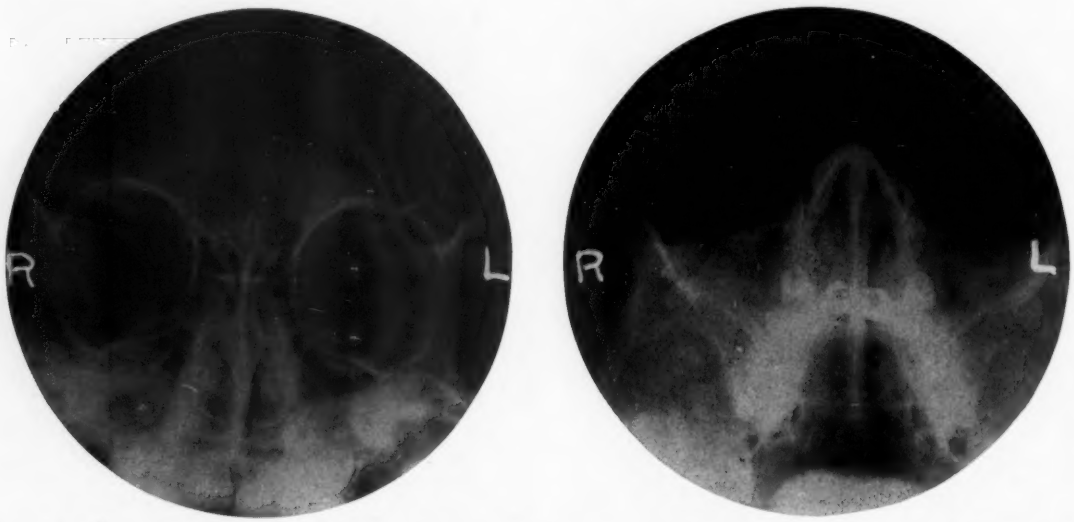

FIG. 5*A*. Case v. The left ethmoidal sinus is hazy. Both antra are opaque and one observes a marked thickening of the lining membrane of the left antrum. Both sphenoids are cloudy (before roentgen therapy).

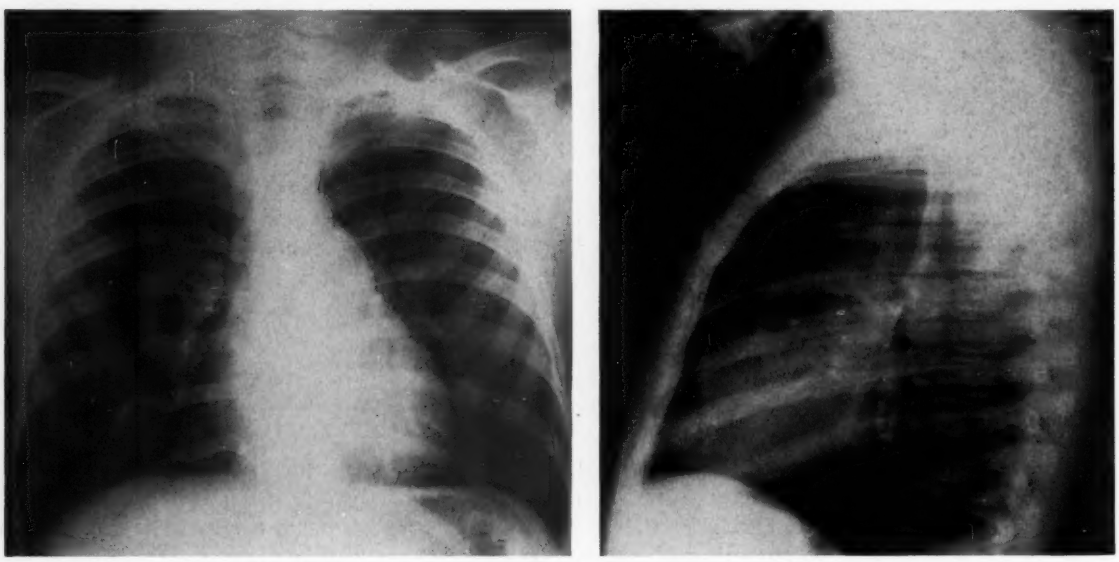

FIG. 5*B*. Case v. Note the moderate root infiltration and the marked lymphoid hyperplasia at the lower trachea and its bifurcation. The enlarged glands produce a narrowing of the lumen of the trachea just above its bifurcation (before roentgen therapy).

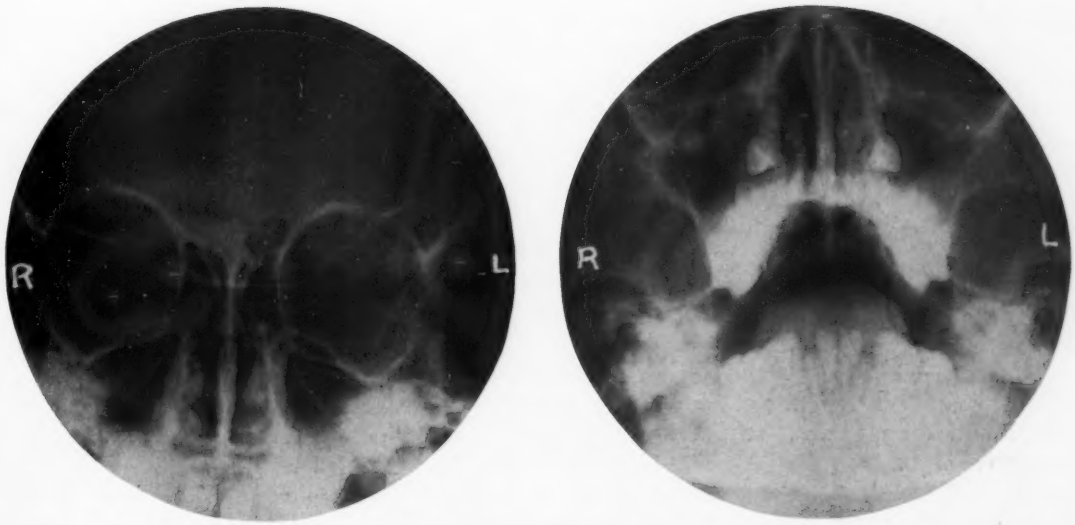

Fig. 5*C*. Case v. After roentgen treatment the left ethmoidal cells as well as the sphenoids are completely reaerated. The right antrum is also reaerated, but there is a residual thickening of the lining of the left antrum. (This disappeared in a subsequent follow-up roentgen study.)

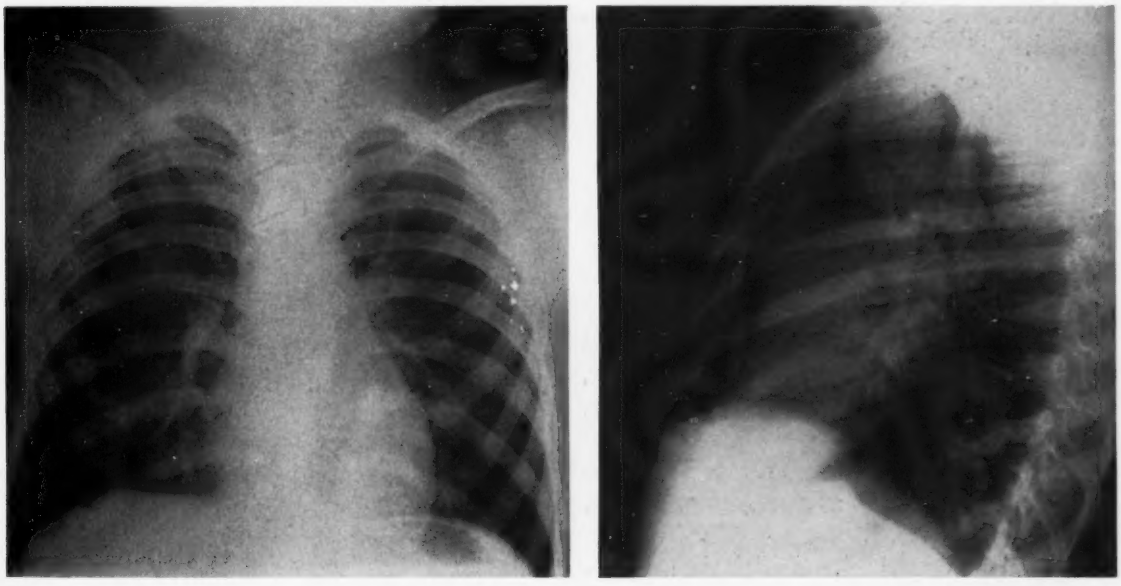

Fig. 5*D*. Case v. After irradiation the right hilus now appears normal. The lymphoid hyperplasia has disappeared. The trachea bifurcation which is obscured in Figure 5*B* can now be clearly visualized.

logically, revealed a haziness of the left ethmoidal sinus and an opacity of both antra with a marked thickening of the lining membrane of the left antrum. Both sphenoidal sinuses were practically obliterated by a thickened mucosa. In the chest, a moderate root infiltration and a marked lymphoid hyperplasia at the lower trachea and its bifurcation were disclosed. The enlarged glands produced a narrowing of the lumen of the trachea just above its bifurcation (Fig. 5*A* and 5*B*).

A diagnosis of sinobronchitis complicated by an allergy was made. The patient was referred to a competent allergist who treated her without improvement. Subsequently roentgen irradiation was given. When examined at the completion of the cycle of treatments the patient lost her cough, the pus in the nose and

the postnasal drip disappeared and the lymphoid elements in the pharynx and nasopharynx were shrunken. Follow-up roentgenograms showed complete reaeration of the left ethmoidal cells, sphenoidal sinuses, and right antrum, but there was some residual thickening of the mucous membrane of the left antrum which disappeared in a later follow-up study. In the roentgenograms of the chest the right hilus appeared normal, and the lymphoid hyperplasia disappeared. The tracheal bifurcation which was originally obscured could now be clearly visualized (Fig. 5*C* and 5*D*). For the past four years this patient has been asymptomatic, manifesting no signs referable to infection or to allergy.

SUMMARY AND CONCLUSIONS

1. Sinobronchitis in children is presented as a distinct clinical entity.

2. The clinical aspects of this infection, based on an analysis of 168 cases, are reviewed.

3. Diagnosis is definitely established by suitable roentgenograms of the sinuses and the chest. The technique of obtaining such roentgenograms is described.

4. Roentgen therapy has been found to be the most effective treatment of sinobronchitis. The full details of the technique of administration are presented.

5. Of 168 cases of sinobronchitis treated with roentgen rays, 98, or 58 per cent, have fully recovered; 47, or 28 per cent, have shown marked improvement; 18, or 11 per cent, have shown moderate improvement, and 5, or 3 per cent, have shown slight improvement.

In conclusion, sinobronchitis is a prevalent disease in children, and well planned roentgen therapy produces effective and gratifying results in the management of this disorder.

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Vol. 67, No. 2

PULMONARY SARCOIDOSIS WITH THE ROENTGENOLOGIC APPEARANCES OF METASTATIC NEOPLASM*

A REPORT OF TWO CASES

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THE manifestations of Boeck's sarcoid in the chest roentgenogram are widely variable and may resemble any of a large group of disease processes, including metastatic neoplasm. However, no previous descriptions can be found of large parenchymal nodules resembling the "snowball" appearance of pulmonary metastatic neoplasm. Two cases seen during the past year at this hospital demonstrating this finding are therefore reported.

CASE REPORTS

CASE 1. A Negro male laborer, aged thirty-one, was admitted on May 25, 1949, with a chief complaint of shortness of breath. Four months prior to admission there had been a gradual onset of exertional dyspnea which progressed in severity and was accompanied by a mild cough productive of small amounts of purulent sputum. The patient consulted his physician who, on the basis of a chest roentgenogram, advised immediate hospitalization.

The patient had been treated on six occasions at this hospital in the past three years for erythema multiforme exudativum. The most recent recurrence of this skin lesion was six months prior to the present admission. During each of these recurrences of dermatitis, the clinical findings were similar, consisting of exudative bullous lesions on the trunk and extremities, with a concomitant severe stomatitis and balanitis. No pulmonary abnormalities were demonstrated clinically or roentgenographically during any of these previous hospitalizations.

Physical examination revealed a well developed, well nourished young Negro male who did not appear ill. Over both posterior lung bases there was decreased resonance and numerous inspiratory crepitant rales. Hyperpigmented iris-shaped scars were present on the trunk and extremities but no active skin lesions were evident. Lymphadenopathy was not present at any time.

Laboratory studies showed a white blood cell count ranging from 7,000 to 10,000 with an eosinophilia of 8 per cent on one occasion. The total serum protein was 8.3 grams per cent with a globulin of 4.1 grams. The serum calcium on one occasion was 14 mg. per cent. The tuberculin and Kveim skin tests were negative. The chest roentgenogram (Fig. 1 and 2) revealed numerous large nodular lesions ranging from 5 mm. to 30 mm. in diameter which were scattered throughout both lung fields. There were also areas of infiltration. Roentgen examination of the hands and feet demonstrated no abnormalities.

During his hospital course the patient was afebrile and, except for exertional dyspnea, asymptomatic. The vital capacity was 2 liters. Six weeks after admission there appeared several bullous skin lesions on the left arm and both legs, and a single lesion on the buccal mucous membrane. Microscopic examination of a biopsy of one of these skin lesions was considered compatible with erythema multiforme. These skin lesions disappeared within a week.

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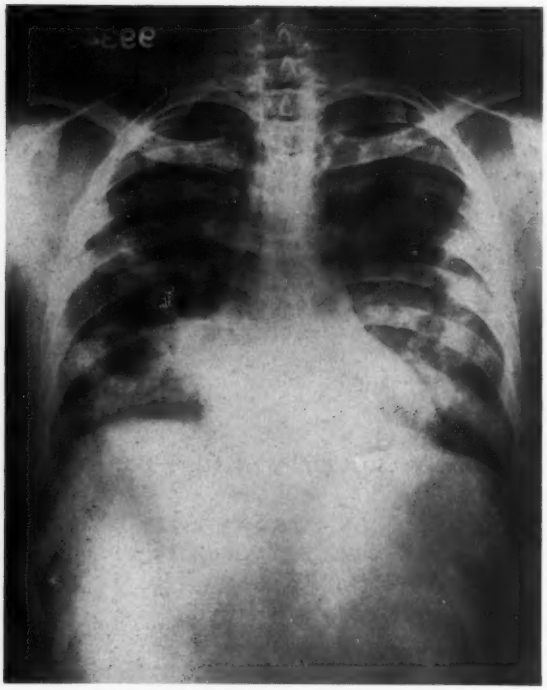

FIG. 1. Case 1. Chest roentgenogram showing large parenchymal nodules and areas of infiltration.

A right epitrochlear lymph node was excised on June 8, 1949, and on microscopic examination revealed only chronic lymphadenitis. For the purpose of establishing a definite diagnosis, a left thoracotomy was performed on July 12, 1949. Numerous firm, rubbery nodules of varying size and shape were seen and palpated throughout the entire left lung. A large nodule in the periphery of the lung parenchyma was removed and on microscopic examination revealed a cellular pattern characteristic of Boeck's sarcoid.

The patient was discharged on August 9, 1949, returned to work in a factory and was able to continue work full time. Five months after discharge, there was no significant change of the vital capacity or the chest roentgenogram.

Comment. No relationship between the dermatologic picture in this patient and the pulmonary disease could be established. There was no similarity clinically, roentgenologically, or microscopically of the pulmonary lesions in this case and in those described in erythema multiforme exudativum.[3] The skin lesions were at no time similar to the nodose erythemas which have been shown to appear with Boeck's sarcoid.[5] This patient demonstrated a marked paucity of symptoms in comparison to the degree of damage demonstrated roentgenologically.

CASE II. A Negro male, aged twenty-four, was admitted on February 7, 1949, with a chief complaint of left anterior chest pain. Since November, 1948, he had had weakness, night sweats, and a 10 pound weight loss. One month later he developed anorexia and bloating after meals. In January, 1949, he developed a productive cough and a vague ache in the left anterior chest.

Physical examination revealed a young Negro male who showed evidence of weight loss and appeared chronically ill. In the left posterior apex and in the right mid-posterior chest there were diminished resonance, voice, and breath sounds. The inguinal and posterior cervical nodes were slightly enlarged but discrete and non-tender. Several weeks after admission, the axillary and epitrochlear lymph nodes became palpable but discrete and non-tender.

A chest roentgenogram revealed widespread "snowball" lesions measuring 5 mm. to 25 mm. in diameter which were distributed throughout

FIG. 2. Case 1. Right lateral chest roentgenogram showing the large nodular shadows.

both lung fields, sparing only the extreme apices (Fig. 3). Roentgen studies of the entire skeletal system, the colon and upper gastrointestinal tract were normal. Retrograde pyelograms revealed clubbing of many of the minor calyces and questionable narrowing of the infundibulae of the right kidney.

The following laboratory studies showed results within the normal range: complete blood count, urinalysis, serologic test for syphilis, blood urea nitrogen, sedimentation rate, electrocardiogram, bromsulfalein test, cephalin flocculation, thymol turbidity, prothrombin time, repeated sputum examinations for acid fast bacilli, bronchoscopic aspiration and sputum studies for fungi and coccidioidin skin test. Kveim skin test and tuberculin test with PPD first and second strengths were negative. The initial total serum protein was 6.1 grams per cent with 2.2 grams of globulin. After seven weeks this rose to 8.6 grams of total protein with 4.1 grams of globulin. The serum calcium was consistently elevated, with levels as high as 16 mg. per cent. The serum alkaline phosphatase was 7.2 units. The peripheral blood showed an eosinophilia of 8 per cent on one occasion. Cystoscopy and bronchoscopy were entirely negative. Vital capacity was 2.2 liters.

Several weeks after admission, his symptoms began to diminish; cough and chest pain disappeared; his appetite and strength increased. On March 16, a biopsy of the left epitrochlear node was performed. Microscopic examination of this tissue revealed a cellular pattern compatible with Boeck's sarcoid. Acid fast stains were negative.

The patient continued to improve, was discharged in May, 1949, and returned to work as a stock boy. Except for mild exertional dyspnea the patient had no complaints. Although vital capacity remained unchanged and serum proteins were still elevated, there was slight roentgenographic evidence of improvement four months after discharge.

Comment. With a chest roentgenogram revealing numerous large parenchymal nodules, an initial diagnosis of metastatic carcinoma was made. However, when the supposed primary site could not be demonstrated and the clinical course continued benign, a diagnosis of sarcoidosis was entertained. This diagnosis was supported by the demonstration of a negative tuberculin skin test and a rise to significantly elevated levels of the serum globulin and serum calcium. The lymph node biopsy established the diagnosis.

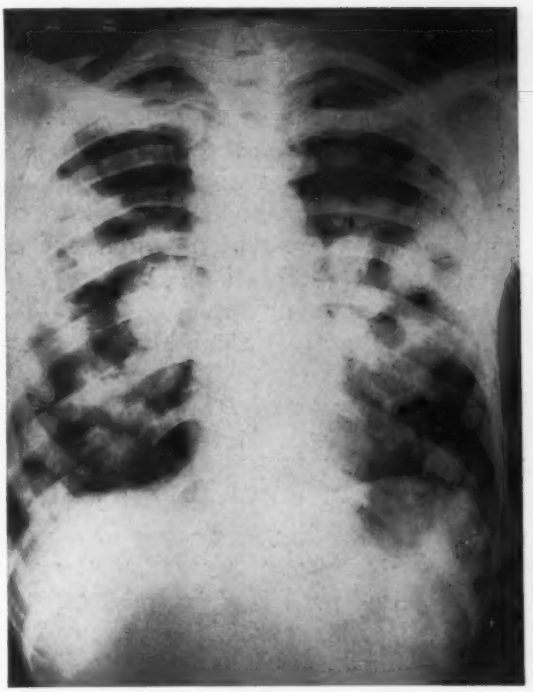

Fig. 3. Case 11. Chest roentgenogram showing diffuse "snowball" parenchymal lesions.

Although there was slight regression of the pulmonary lesions roentgenologically, the clinical improvement was more marked and, as is typical of this disease, there was little correlation between the roentgenographic and clinical picture.

DISCUSSION

The literature contains a great variety of descriptions of the roentgenographic manifestations of pulmonary sarcoidosis. It has been suggested[1,4] that this variability is due in part to the fact that the same patient may present a different roentgenologic picture at various phases of the disease. Many authors have classified these pulmonary lesions.[1,2,4,6,8] Three distinct types of lesions are commonly described: (1) diffuse miliary or nodular forms; (2) linear or reticular striations; (3) localized or pneumonic infiltrates.

Little has been said in previous reports

regarding the actual size of the nodular form of sarcoidosis. In Garland's series,[4] the nodular densities ranged from 1 to 5 mm. in diameter. In Kerley's series[5] of pulmonary densities thought to be sarcoidosis associated with erythema nodosum, the nodules averaged 3 mm. in diameter. In the 2 cases presented above the nodules are unusually large, varying from 10 to 30 mm. in diameter.

These nodules are thought to represent the involvement of foci of lymphoid tissue in the lung parenchyma by the sarcoid granuloma.[5] To explain the presence of large nodules, it can be postulated that there is either a more marked lymphoid reaction of the disease or that this represents a coalescence of several smaller nodules present in adjacent lymphatic tissue. Considering the natural course of other types of pulmonary lesions in sarcoidosis, the latter explanation is more likely.

SUMMARY

Sarcoidosis has been demonstrated to mimic several forms of pulmonary metastatic malignancy. A further form, not previously described, is exhibited by two proved cases of pulmonary sarcoidosis in which large parenchymal nodules are indistinguishable from the "snowball" lesions of metastatic malignancy.

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Vol. 67, No. 2

A PLEA FOR ROUTINE POSTMORTEM CHEST TELEROENTGENOGRAMS*†

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NEW YORK, NEW YORK

A SOMEWHAT apparent lack of correlation between the last antemortem chest roentgenogram and the reported pathological findings in some of our cases has on occasion been a source of embarrassment and even chagrin.

Attempts to explain away these variances to the resident roentgenologist assigned to the postmortem room and to the non-roentgenological medical staff in the clinical pathological conferences were unconvincing and unsatisfactory, thus lessening the actual value and the relative importance of the roentgenographic method.

This has led us to investigate the possible reasons for these apparent discrepancies. The chief observation was that the postmortem pathological findings were the end and final results of the patient's disease processes while the last available antemortem chest film simply mirrored one stage in the development of those final findings and consequently could not properly be considered as anything but the exact representation of the disease processes at the moment of the film exposure. The pathological changes incident to the usual rapid retrogressive progress between the last antemortem film and autopsy were thus inadvertently excluded from the correlative considerations. These late changes may include rapid fluid accumulation, hemorrhages, rapid disseminations of disease processes, etc. Very often the postmortem chest film is of better quality than the last antemortem film because the latter is usually obtained at the bedside with a non-teleroentgenographic technique on a patient too sick to cooperate, with the resultant unsharpness of images and other distortions.

The net result was to institute a routine to obtain a postmortem chest film and an interpretation thereof just before autopsy. This has completely narrowed the time gap and has brought about a greater final harmony between the roentgenographic and the pathological findings.

HISTORICAL

In 1940 Hampton and Castleman[1] made a correlative study of postmortem chest films and the autopsy findings, with special reference to pulmonary embolism and infarction. In this study they pointed out that detailed confirmation of the interpretations of chest roentgenograms taken before death is often difficult to obtain.

TECHNIQUE

The program is carried out by the resident in radiology on assignment to the department of pathology for training. In his absence the work is performed by the radiological resident on duty. To date, 350 such examinations have been performed.

The simplest method is to obtain an anteroposterior chest teleroentgenogram in the supine posture, utilizing a portable apparatus especially assigned for such work in the autopsy room.

The films are studied by the resident roentgenologist but the report of record is made by a senior staff member in order to include an element of experience.

An improvement upon this routine is to

* From the Department of Radiology, Veterans Administration Hospital, Bronx, New York. Reviewed in the Veterans Administration and published with the approval of the Chief Medical Director. The statements and conclusions published by the authors are the result of their own study and do not necessarily reflect the opinion or policy of the Veterans Administration.

† Thanks are due to Dr. Charles Gottlieb, Senior Consultant, for his kind encouragement.

‡ Deceased.

obtain posteroanterior and lateral projections in the prone posture. The most ideal method is to obtain the upright views with the cadaver suspended by a halter as originally described by Hampton and Castleman. A further refinement described by these investigators is to instill Kaiserling solution No. 1 by gravity through the trachea until both lungs are approximately the same size as they were during life. The trachea is clamped and the specimen submerged in a large crock containing the same fixative and allowed to remain for about one week. At this time the lungs are sectioned by the pathologist in the presence of the roentgenologist and explanations are

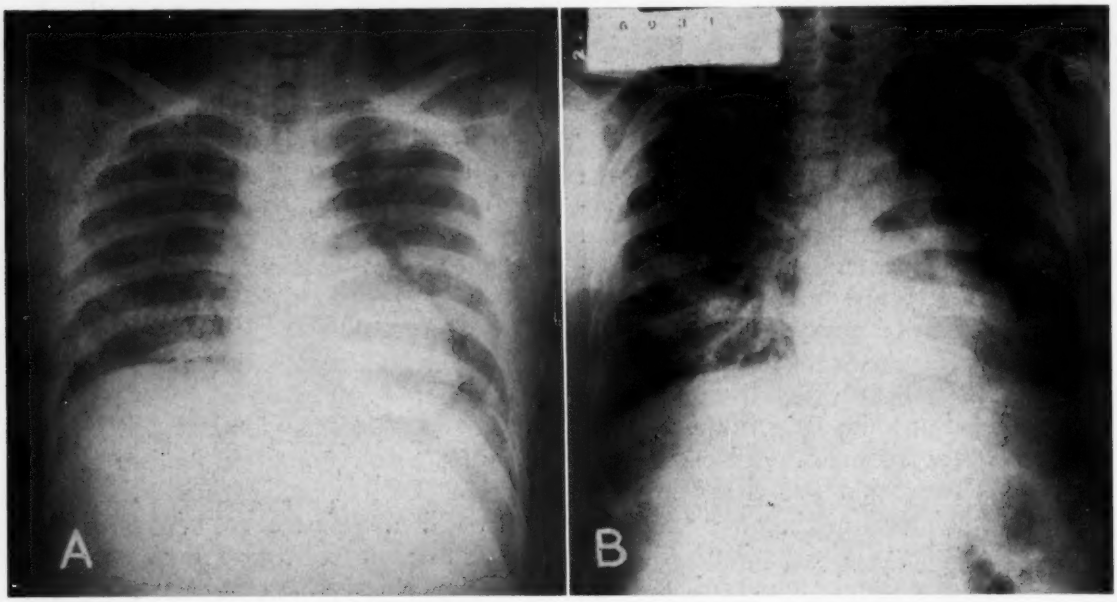

FIG. 1. Case I. (*A*) Antemortem chest roentgenogram suggestive but not conclusive for disseminated tuberculosis. (*B*) Postmortem chest roentgenogram showed widespread parenchymal infiltrates, enlargement of the mediastinal nodes and right pleural effusion, indicative of disseminated hematogenous tuberculosis.

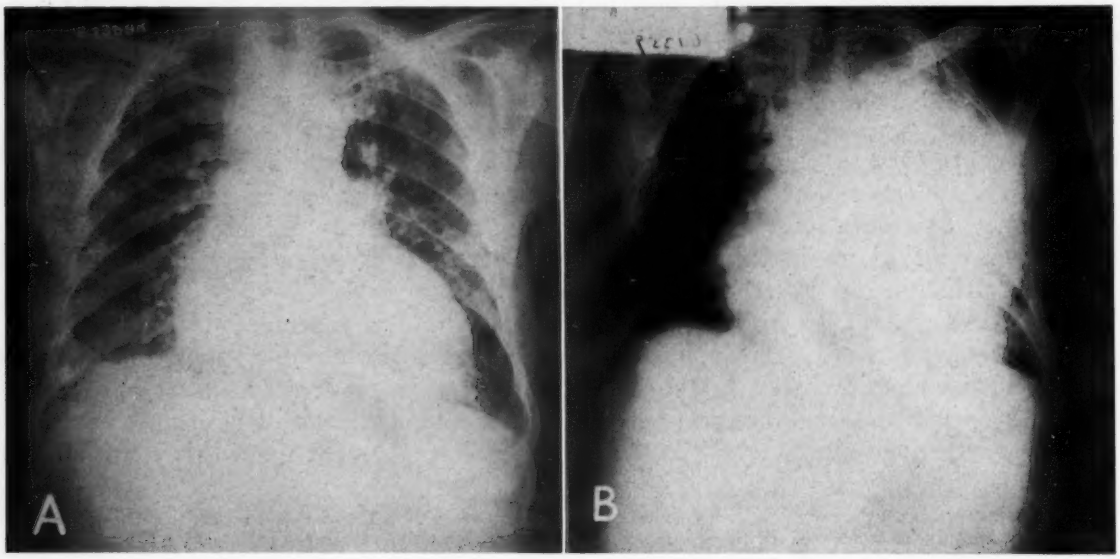

FIG. 2. Case II. (*A*) Antemortem chest roentgenogram showed some evidence of congestive failure, but nothing to indicate presence of pneumonia. (*B*) Postmortem chest roentgenogram showed massive lobar pneumonic consolidation in the left upper lobe.

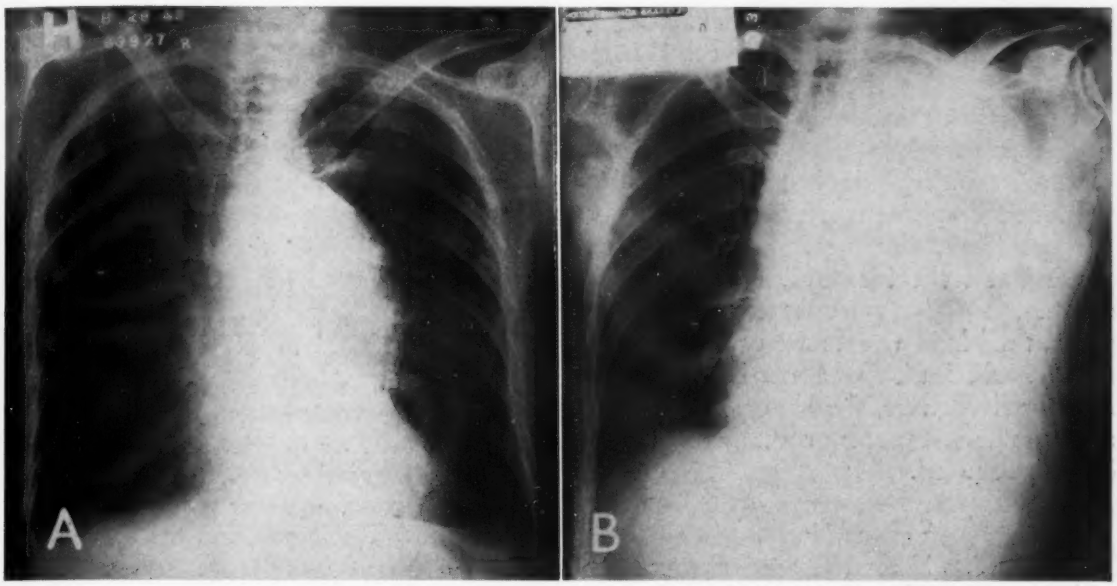

Fig. 3. Case III. (*A*) Antemortem chest roentgenogram showed large aneurysm of the aorta. Postmortem chest roentgenogram showed two large encapsulations of fluid in the left hemithorax.

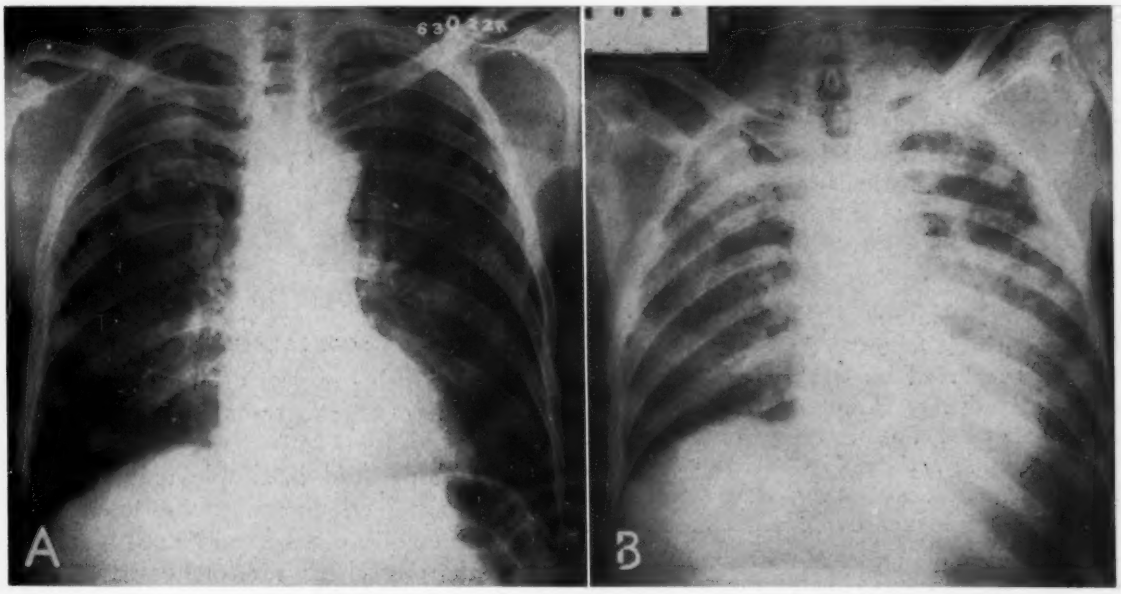

Fig. 4. Case IV. (*A*) Antemortem chest roentgenogram showed nodular infiltrate in the right upper lobe with lytic lesions involving the right third and ninth ribs. (*B*) Postmortem chest roentgenogram showed extensive lymphangitic carcinosis of the lungs with marked progression of the metastases in the bony thorax and considerable increase in size in the right upper lobe infiltrate.

carefully sought for the various roentgen findings.

The halter and fixative methods have not been used by us because they are not easily applicable. We have continued with the simple supine films since there is no objection to the procedure.

THE NORMAL POSTMORTEM CHEST ROENTGENOGRAM

Hampton and Castleman state that after death there is incomplete aeration of the lungs, apparently due to narrowing of the intercostal spaces, the high position of the diaphragm and the contraction of the lung

because of its inherent elasticity. Suspension of the body by the halter method helps to compensate for the above.

They state that the postmortem roentgenogram corresponds to the antemortem film taken during quiet breathing or expiration. The diaphragm is usually two interspaces higher, the upper lobes fairly expanded and the lower lobes incompletely aerated. In the postmortem roentgenogram, the blood vessels are usually smaller and less distinct, the aorta is about one-half the living size, the heart size variable, and the anteroposterior diameter of the chest is reduced.

CASE REPORTS

CASE I. A white male, aged twenty-eight, with a previous history of pleural effusion and tuberculous spondylitis experienced an extreme temperature rise shortly after removal of an epididymis. An antemortem chest roentgenogram was suggestive but not conclusive of disseminated tuberculosis. A postmortem chest film showed widespread parenchymal infiltrates, enlargement of the mediastinal nodes and pleural effusion indicative of disseminated hematogenous tuberculosis. This was confirmed by autopsy. The enlarged nodes and the pleural effusion were not visualized on the antemortem film.

CASE II. A white male, aged fifty-five, with congestive heart failure and uremia on a hypertensive basis died six weeks after admission, apparently due to the uremia. There was no note in the final clinical summary of a terminal febrile episode and the last antemortem chest roentgenogram made on October 12, 1949, failed to show evidence of pneumonia. A chest roentgenogram, however, made just after death on October 31, 1949, prior to autopsy demonstrated a lobar pneumonic consolidation of the left upper lobe. This was confirmed by autopsy.

CASE III. A white male, aged fifty-six, with a large aneurysm of the arch and upper portion of the descending aorta experienced a sudden onset of severe left chest pain on October 2, 1949. He was found to be in extreme shock soon thereafter and died in ten hours. An antemortem film on August 29, 1949, had visualized a large aneurysm but no other significant abnormality. A chest roentgenogram made after death on October 3, 1949, just prior to autopsy showed two large encapsulations of fluid in the left hemithorax (probably due to rupture of the large aneurysm which was also visualized). This was confirmed by postmortem examination.

CASE IV. A white male, aged fifty-six, was admitted with an infiltrate in the right upper lobe. This was thought to be tuberculosis because of the past history. There were lytic lesions involving the right third and ninth ribs. These were suspected of being metastases from a distant primary focus. This was never confirmed. The patient grew progressively worse and died one month after admission. A chest roentgenogram made after death just prior to autopsy showed for the first time an extensive lymphangitic carcinosis of the lungs with marked progression of the metastases of the bony thorax. The infiltrate in the right upper lobe had grown considerably since the last antemortem film. On the basis of these findings it was now felt by the Department of Radiology that we were dealing with a right upper lobe peripheral bronchogenic carcinoma with extensive metastases to the bony thorax and extensive bilateral lymphangitic spread. This proved to be true at autopsy.

These 4 cases, briefly presented, give a clear idea as to the actual and potential value of routine postmortem chest roentgenography. Such examinations are especially valuable when autopsy permission is not obtainable or in medicolegal cases.

CONCLUSIONS

1. The advantages of taking routine chest teleroentgenograms have been outlined.

2. The method is simple and inexpensive. No objections are encountered from any source because it is no more objectionable than a chest roentgenogram taken during life.

3. A plea for more extensive utilization of the method is hereby entered.

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Vol. 67, No. 2

PLACENTAL CALCIFICATION IN THE ROENTGEN PREGNANCY STUDY

By JOSEPH F. LINSMAN, M.D., *and* JACK I. CHALEK, M.D.
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ROENTGEN visualization of the placenta by soft tissue technique (direct placentography) is a well established procedure, and in any complete roentgen pregnancy study the identification of the placenta should be a routine requirement. The obstetrician who is confronted with bleeding in the last trimester of pregnancy is quite relieved to learn by the simple expedient of roentgen studies, without contrast medium, that the placenta has been identified and cannot possibly be in the lower uterine segment. Conversely, he is most grateful if he can ascertain that either a placenta previa or a low lying placenta is present without the hazard of intravaginal digital examination.

Though direct placentography ranges to 98 per cent[8] accurate among experienced radiologists, with excellent films, any additional sign that will facilitate the identification of the placenta (or placentas in multiple pregnancies) should be of considerable value. Placental calcification can be such an aid in roentgenographic localization of the placental site.

PHYSIOLOGICAL AND PATHOLOGICAL ASPECTS

Calcification of the placenta is well known as a clinical and pathological entity. The conditions usually responsible for soft tissue calcification are ideal in placental physiology and in the normal metamorphosis of the organ.

The placenta, being essentially an organ with nutritional function, is well supplied with minerals, and the amount of these minerals, as well as other food essentials, varies during gestation to meet the demands of the growing fetus.[7] Since it is a chief excretory organ of the fetus, some calcium may be eliminated from the blood into it. When one considers the widespread degenerative changes that are occurring as the placenta matures, the stage is then set for calcium precipitation as the calcium concentration reaches certain levels. Depletion of maternal calcium stores occurs in appreciable amounts only during the last two months of pregnancy,[1] and it is at this time that the placenta contains more calcium within it.[6]

Schönig[10] demonstrated that the calcium was deposited in the necrotic tissue surrounding the ends of the "fastening" villi as well as in the superficial layers of the decidua basalis. Masters and Clayton[6] studied calcification of the human placenta and also showed that the calcium was present in areas where the villi had degenerated and that the parts of the villi chiefly involved were those nearest the maternal surface, that is, farthest from the fetal blood supply.

PREVIOUS REPORTS

Since roentgen diagnosis is dependent upon differences in tissue densities, the presence of calcium deposits in a soft tissue mass makes conditions ideal for easy identification of that mass. It is therefore surprising that more stress has not been placed on calcium deposits in the placenta as a means of positive identification. In publications on the subject of direct placentography, isolated cases of calcification of the placenta have been included,[2,8] but the finding is usually referred to as being unusual and sufficiently infrequent so as not to be an aid in placenta localization. Dippel and Brown[4] found only 6 instances in which calcium was visualized on roentgen studies of placentas in 261 cases, and therefore reached this conclusion. However, the mean duration of pregnancy in their group was 35.5 weeks. Thomas[9] reported a single case of placental calcification and

FIG. 1. Heavy stippled calcium deposits identify the placenta on the fundus wall anteriorly.

FIG. 2. Moderately heavy stippled calcium deposits are present in the anterior placed placenta.

predicted that with the general improvement in technique along with the use of the rotating anode tube, placental calcification would be observed more frequently.

AUTHORS' FINDINGS

We have been impressed with the frequency of calcium deposits in the placenta in our routine roentgen studies in pregnancy. As part of every pregnancy study referred to us for pelvimetry, we obtained anteroposterior and lateral views of the abdomen.

FIG. 3. Heavy calcium deposits, punctate in nature, are distributed throughout the placenta, which is on the posterior uterine wall.

We carefully studied 100 consecutive cases in the last four weeks of pregnancy (most of the cases were at the 38–39 week of gestation), and in this series, we were able to identify placental calcification unequivocally in 34 cases (34 per cent). The lateral view was the most important one in detection of this finding.

The calcium was usually distributed in either patchy or diffuse punctate deposits (Fig. 1, 2, 3 and 4), but occasionally it had a lace-like appearance (Fig. 5 and 6). The quantity of calcium varied from barely perceptible to rather extensive amounts. In 2 cases where twins were present, two separate placentas, each containing a moderate amount of calcium, were identified (see Fig. 7).

Fig. 4. The placental calcium deposits are very sparse. The placenta lies on the lower mid-anterior uterine wall.

Fig. 5. Rather heavy reticulate calcium deposits in a placenta on the mid-anterior uterine wall.

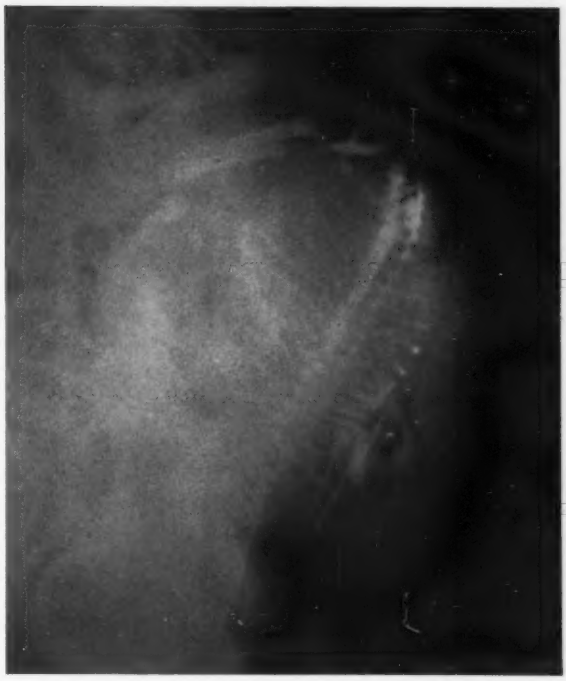

Fig. 6. Delicate lace-like calcium deposits in a placenta on the mid-anterior uterine wall.

Our patients were, for the most part, primigravidas from average or better than average walks of life, with normal average diets, who were referred to us by twenty-nine obstetricians. In many instances, their diets were supplemented by calcium and vitamins. It was established that the

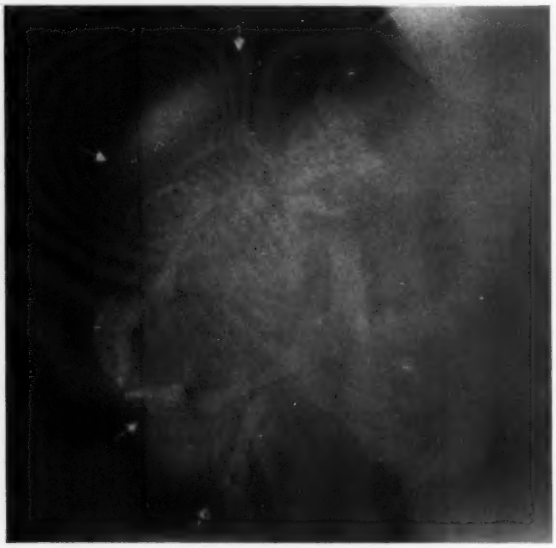

FIG. 7. Twin pregnancy, showing two calcified placentas (arrows).

patients who supplemented their diets with calcium and vitamins or those who drank a great deal of milk or ate much cheese showed calcium more frequently and in greater amounts than those who did not. The cases of one obstetrician who gives no supplementary diet to his patients showed the presence of calcium in the placenta in only 2 of 40 consecutive cases (not all included in this series). Brehm[3] demonstrated that there was definite increase in the amount of calcium in placentas when the diet contained supplemental calcium and vitamin D.

We observed that term or post-term pregnancies showed a greater amount of demonstrable calcium in the placenta. Albright and Reifenstein[1] point out that the placenta becomes an appreciable source of maternal calcium loss in pregnancy only during the last two months of gestation..

TECHNICAL CONSIDERATIONS

In order to demonstrate calcium in the placenta, especially when present in small amounts, the roentgenogram must be of the finest technical quality. Roentgenographic screens must be clean. A rotating anode tube, the Potter-Bucky diaphragm, and short exposure time are all necessary. We routinely employed a cone in our studies.

The factors for the lateral view were 200 ma. with 68 to 75 kv. (peak), depending on part thickness and time exposure of one-half second. For the anteroposterior view, we employed 150 ma. with 68 to 75 kv. (peak), and time exposure of one second. The target-film distance was 40 inches. The usual time temperature method of film development was used.

If motion is present in the fetus or uterus, another roentgenogram will often reveal calcium in the placenta where it was not discernible previously. Motion may be imparted by breathing by the patient, by a moving fetus, or by marked pulsations of the aorta. We did not routinely employ the practice of having the patient take several deep breaths in order to better oxygenate the fetus so as to stop fetal motion, as has been recommended. We used no special filter in our studies of the placenta in the lateral views, as has also been recommended.[11]

DIFFERENTIAL DIAGNOSIS

The differential diagnosis of calcium in the placenta from other calcifications is rather easy. Fibroids commonly calcify as either dense collections of mottled, fairly well circumscribed zones, or as peripherally placed calcifications of annular configuration (Fig. 8). A dermoid should give no differential difficulty (Fig. 9). Feces in the colon overlying the placental shadow can be confusing, but the location in the colon and the mixture of the fecal material with colonic gas results in rather easy differentiation. If partially calcified costal cartilages overlie the placental shadow when it is located in the uterine fundus, some diagnostic difficulty may be encountered, but these calcifications can be traced into the ribs. Calcified mesenteric lymph nodes are usually classical in appearance and are dense irregular aggregates of calcium as compared to the stippled or web-like appearance of placental calcification.

DISCUSSION AND COMMENTS

The high frequency of placental calcification in our study is not at variance with postpartum roentgen studies of the placenta done by Fleming.[5] She examined 200 placentas and found that 26 per cent showed no evidence of calcium, 49 per cent had a slight amount of calcium, and 25 per cent had a marked amount of calcium. Fleming showed that there was evidence of some relationship between the amount of calcium in the placenta and the administration of "adequate supplementary amounts of vitamins A, B, C, and D and of calcium, iron, iodine, manganese, and copper" in addition to the maternal diet. Her work was based on the demonstration by Masters and Clayton[6] that roentgen studies of the removed calcium-containing placenta were as reliable as chemical analysis.

Most investigators of direct placentography state that the placenta is either on the anterior or posterior walls of the uterus. Therefore, the lateral view is the most useful. It has been our experience that when the placental shadow was not identified in the lateral view (and this is rare), it often could be definitely identified in the anteroposterior view only because of the presence of calcifications in it (Fig. 10). In these cases, the placenta was either on the right or left lateral wall of the uterus. This finding excluded the diagnosis of placenta previa, a diagnosis which must be seriously entertained when the placenta cannot be identified outside of the true maternal pelvis.

In hydramnios, where the uterine wall merges with the shadow of the excess amnionic fluid about the fetus, calcification in the placenta is the only definite means of its identification. In marked obesity of the mother, it has also been of some value since the very obese patient is often a poor subject for direct placentography. Identification of the placentas in twins can be made with certainty if there is placental calcification (Fig. 7).

When there is a low implantation of the

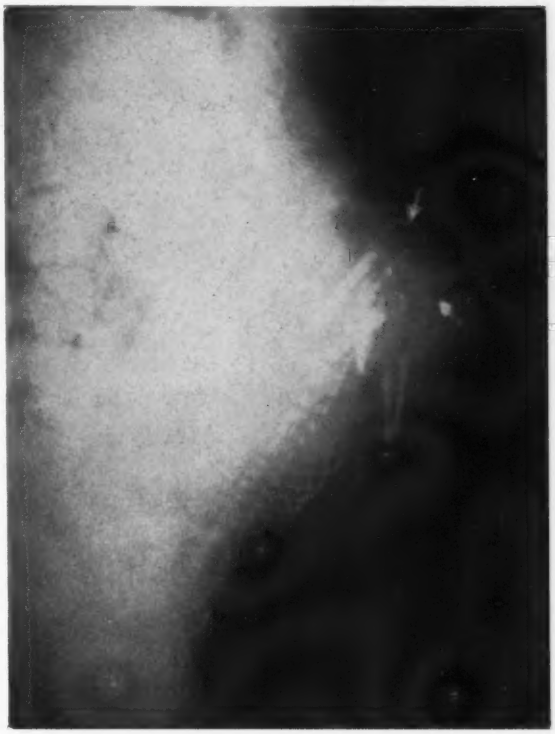

FIG. 8. Calcified leiomyoma of the uterus (arrows). The placenta is not calcified and is on the anterior upper uterine wall.

FIG. 9. A dermoid tumor of the ovary containing a tooth. Its outline (arrows) confines a radiolucency due to its fat content.

FIG. 10. Calcification identifies the placenta on the lateral uterine wall (arrows).

placenta, one can be much more certain of this roentgen diagnosis if the placenta tail contains calcium and lies alongside the fetal head. The diagnosis of a placental shadow overlying the uterine os (central placenta previa) can be unequivocally made if it contains typical calcium deposits.

The finding of calcification in the placenta, no matter how extensive, is in no way indicative of either placental disease or fetal abnormality.

CONCLUSIONS

1. The presence of calcification in the placenta is a distinct aid in the localization of the placenta in direct placentography.

2. In a series of 100 consecutive pregnancy studies past the thirty-fifth week of gestation (average gestation 38–39 weeks), roentgen identification of calcium in the placenta was made in 34 per cent.

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Vol. 67, No. 2

TREATMENT OF ANGIOMAS

SUMMARY OF TWENTY YEARS' EXPERIENCE AT COLUMBIA PRESBYTERIAN MEDICAL CENTER*

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DURING the past twenty years there have been 677 angiomas treated at the Columbia Presbyterian Medical Center and 499 of these were treated in the dermatologic service, 178 being treated by the surgical and other services. The indexing of diagnoses in the out-patient department is several years behind so these figures are much smaller than they should be. In this time the authors have treated also 562 angiomas in their private practice. These are included in this summary of a total of 1,239 cases. This comprises 321 cases of nevus flammeus and nevus araneus, and 892 cases of hemangioma simplex or cavernosum. There were 26 lymphangiomas.

Six hundred and two of the patients were one year of age or younger. There were 842 females and 397 males in the entire group. In the group of hemangioma simplex and cavernosum there were multiple lesions in 171 cases (19 per cent) and single lesions in 721 (81 per cent). In 545 cases (60 per cent) the lesions were on the head, and in 392 (44 per cent) the angiomas were on the face. The cheeks were involved in 116 cases (approximately 13 per cent and the nose in 71 cases (approximately 8 per cent).

SPONTANEOUS DISAPPEARNCE

It is common for hemangiomas to disappear spontaneously. Lister,[8] Hopkins,[7] Watson and McCarthy,[12] and Ronchese[11] have made excellent statistical contributions which prove beyond doubt that if left untreated for five years many hemangiomas disappear spontaneously.

It is also common for hemangiomas not to disappear but to grow larger, to become ulcerated, to cause destruction of the soft tissues, and disfiguring scars. In 90 per cent of the angiomas in this series the lesion was present at birth or appeared within the first few weeks after birth as a tiny spot which grew much larger, sometimes to huge size, while the parents were anxiously waiting for it to disappear spontaneously. In all of the severe cases, the family doctor or pediatrician had advised the parents to have no treatment because the angioma in all probability would disappear spontaneously. Often parents were told that the baby was too young or too undernourished to have treatment. In premature babies this seemed invariable advice.

Many of the large and ulcerated angiomas were actually caused by the poor advice given by the local doctors to the parents. Many bad scars were due to such advice.

It is important that doctors learn that angiomas are very easy to treat when they are first noticed and that it is unwise to wait for them to disappear spontaneously. It is much safer to treat them effectively at once and thus prevent all danger of their growing larger, ulcerating and seriously threatening the child with disfigurement. This is especially important because the majority of angiomas are on the face, with more frequency in girls. It is important that information be spread that no age is too early and that the treatment of these small lesions by solid carbon dioxide, or irradiation, if done by a diplomate of the American Board of Dermatology or experienced radiologist, is perfectly safe and should cause no anxiety

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no matter how young or premature the patient.

In the first few weeks of life when the incipient angioma appears and is small, it is not so much a matter of what type of treatment should be given as it is important that some effective treatment be given.

If all doctors would follow this advice, there would be many less large angiomas to treat and few angioma treatment problems. It is the failure of the family physician and pediatrician to give this advice and the tendency to belittle the importance of a small birthmark that frequently produce the serious treatment problems.

RADIUM TREATMENT

During the past twenty years we have learned a great deal about the use of radium and roentgen rays. The senior author was trained by Dr. George M. MacKee with the best technique known twenty-five years ago when angiomas were treated by radium plaques with thin screens of aluminum. The caustic beta-ray effect caused so much atrophy and scarring that this method was soon abandoned. Subsequently, silver screens were used. Steel and platinum needles gave better results. Then gold and platinum implants were inserted interstitially. The results from these implants were, on the whole, very poor. Glazed plaques filtered through 2 mm. of brass, and brass trays applied at 1 cm. distance were next used. It gradually became clear that gamma-ray plaques or trays in contact or at a few millimeters distance gave uniformly good results so long as the dose was

FIG. 1, 2 and 3. Fig. 1. October 27, 1949, at age of five months, before treatment. Ulcer 6 by 8 cm. Leukocytes 19,000; hemoglobin 60 per cent. Fig. 2. December 2, 1949, at age of seven months, after one radium treatment and 100,000 units penicillin, daily, for two months. Blood count normal. Fig. 3. May 8, 1950. After three radium treatments. One more treatment will probably be required.

This mark began as a dime-sized angioma. Parents were told repeatedly by the pediatrician that it would disappear spontaneously and were advised to have no treatment.

kept low and treatments were spaced wide apart. Always, the principle must be kept in mind that the only injuries from radium are from over-treatment. Reactions must always be avoided. It is better to give a small dose and to repeat that rather than so much it can do harm. It has become more and more apparent that the best cosmetic results are obtained by successful radium treatment and that the simple use of one or more gamma-ray plaques suffices for 95 per cent of angiomas. Since this method has been used there have been no bad results. For the last twenty years it has been the standard form of therapy with us.

Although the treatment distance is short, the reduction in dose with depth is not significant for the first few millimeters due to the relatively large area of the source. Furthermore, the plaques are applied tightly with elastoplast* strapping so that most of the blood is forced out and the angioma is compressed. The angioma is like a small sponge and squeezing out the blood leaves little of the mass remaining. Of course, in those angiomas which are still 1 cm. or more in thickness when compressed, the gamma-ray tray at 1 cm. distance is preferred. These treatments have been described previously by the senior author,[3,4,5,6] but a brief review follows. Those interested should read previous articles which give the techniques in more detail than space permits here.

First: The simple treatment with plaques is suitable for the vast majority of hemangiomas. Full strength radium plaques (5 mg. per sq. cm.) are filtered through 2 mm. of brass and kept on the skin for three and a half hours. (Measurements of this dosage in roentgens is not feasible.) One or more of these plaques are used, according to the size of the angioma. At least three months must elaspse before treatment is repeated. A total of no more than four such treatments should be given an angioma. Most angiomas can be cured in three or four of these treatments. Often, two or three treatments suffice and sometimes one such

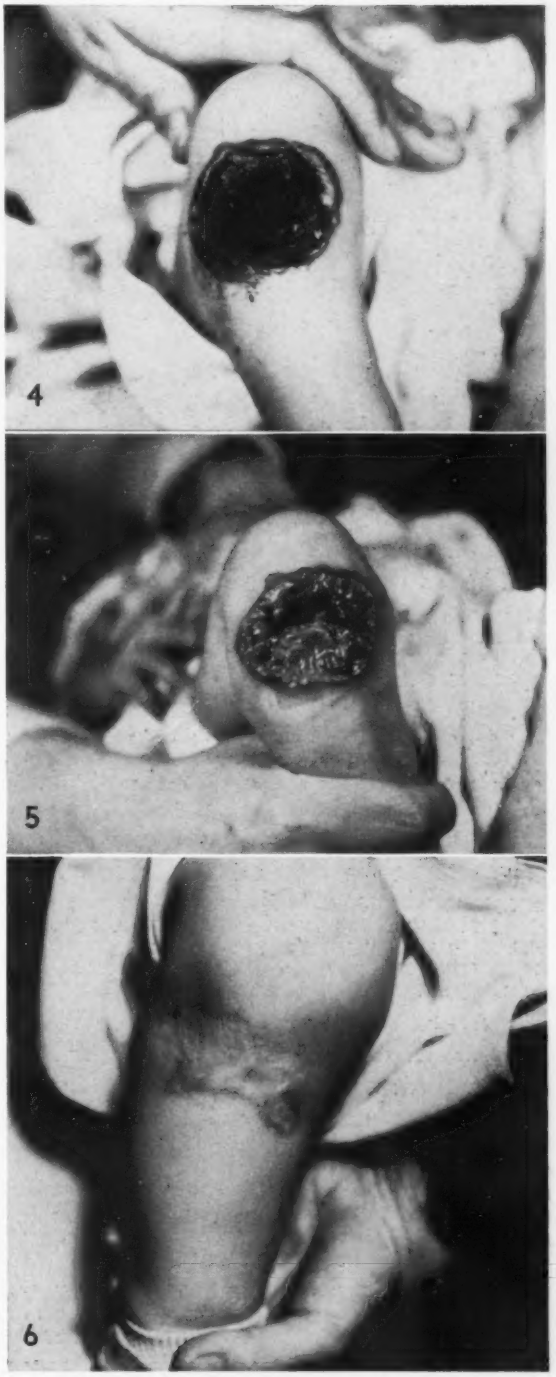

Fig. 4, 5 and 6. Fig. 4. Patient, aged three months. Started as a fingernail-sized red spot. Advised against treatment—that it would go away by itself. Now bloody, ulcerated 6 by 6 cm. Fig. 5. Five days later after penicillin, 100,000 units daily. Fig. 6. Six months later after one radium treatment.

Improper advice led to this condition. If the mark had been treated when first seen, there never would have been any problem.

* Elastoplast—Duke Laboratories, Inc., Stamford, Conn.

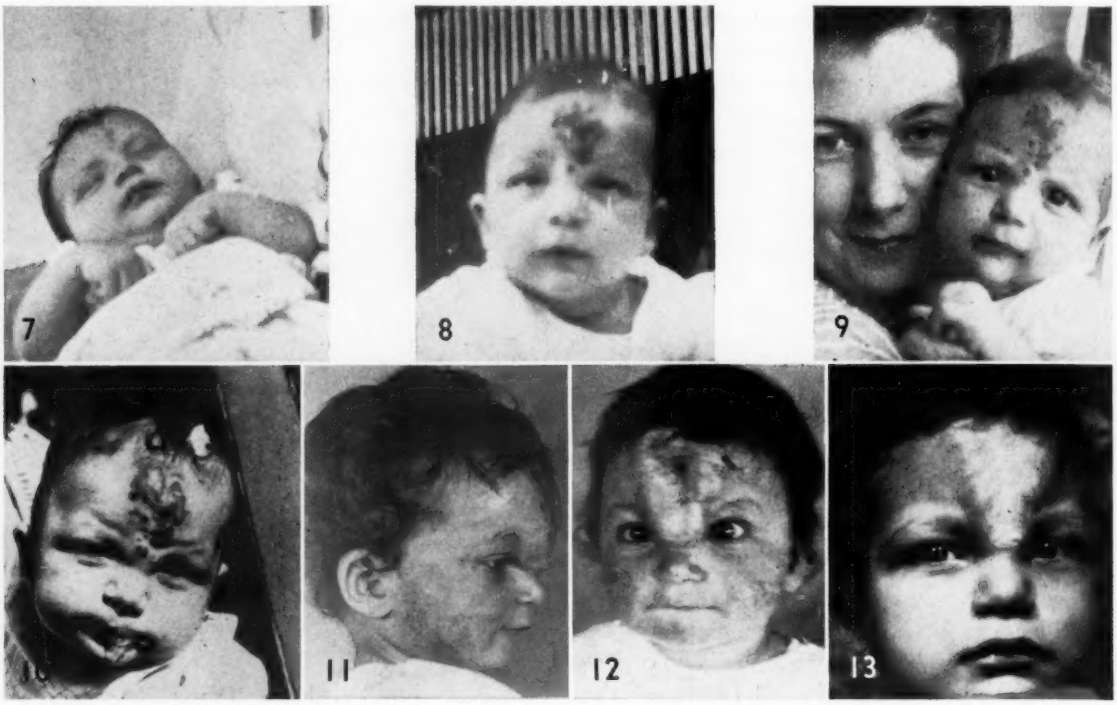

FIG. 7–13. To show results of improper advice and treatment. The mother was told this mark would disappear if she let it alone.

Fig. 7. Size at one and a half months. Fig. 8. At two months. Fig. 9. At two and half months. Fig. 10. At five months. Fig. 11 and 12. At eleven months after six solid carbon dioxide treatments. Fig. 13. At two years after three radium treatments. Scarring caused by previous ulceration and carbon dioxide.

treatment gives a complete cure. Rarely, some remnant may persist after four treatments. This will disappear in time. It will never grow again. Lack of coaptation of the plaque to the angioma is the most likely explanation of failure to get a complete cure in three or four treatments.

The filters used for these plaques are tray shaped and extend up over the sides of the plaque. There is little danger of cross-firing or overlapping from one plaque to another.

Second: For the treatment of a few bulky hemangiomas radium trays at a distance of 1 cm. are used. These are flat brass trays 1 mm. in thickness. They contain several small silver tubes so that the filtration is the equivalent of 2 mm. of brass. This tray is placed on a block of balsa wood or cork having a thickness of 1 cm., so the radium is actually at a distance of 11.5 mm. from the skin. The applicators we use are of the sizes shown in Table I.

A statistical study of the results attained by these techniques in the last ten years

TABLE I

Applicator Size	Distance	Strength	Exposure	100 mg. hr.	Roentgens*		
					Surface	At 5 mm.	At 1 cm.
Rectangle 3 by 4 cm.	1 cm.	70 mg.	3½ hr.	2.45	750	450	300
Rectangle 2 by 3 cm.	1 cm.	75 mg.	2½ hr.	1.87	720	430	280

* As estimated from Paterson and Parker tables: Quimby, E. H. Dosage calculations in radium therapy. AM. J. ROENTGENOL. & RAD. THERAPY, 1947, *57*, 622.

shows excellent cosmetic results without atrophy of the skin or other sequelae in all cases of hemangioma simplex or cavernosum. Scarring from previous carbon dioxide treatment was frequently seen and scarring occurred after the treatment of crusted or ulcerated lesions.

This radium dosage is safe at any age. injections of sclerosing solutions. There have been no bone injuries.

In the treatment of hemangiomas one is interested especially in the cosmetic result. This is a completely different objective from that in the treatment of epithelioma, in which the cure rather than the appearance is paramount. To obtain a good cosmetic

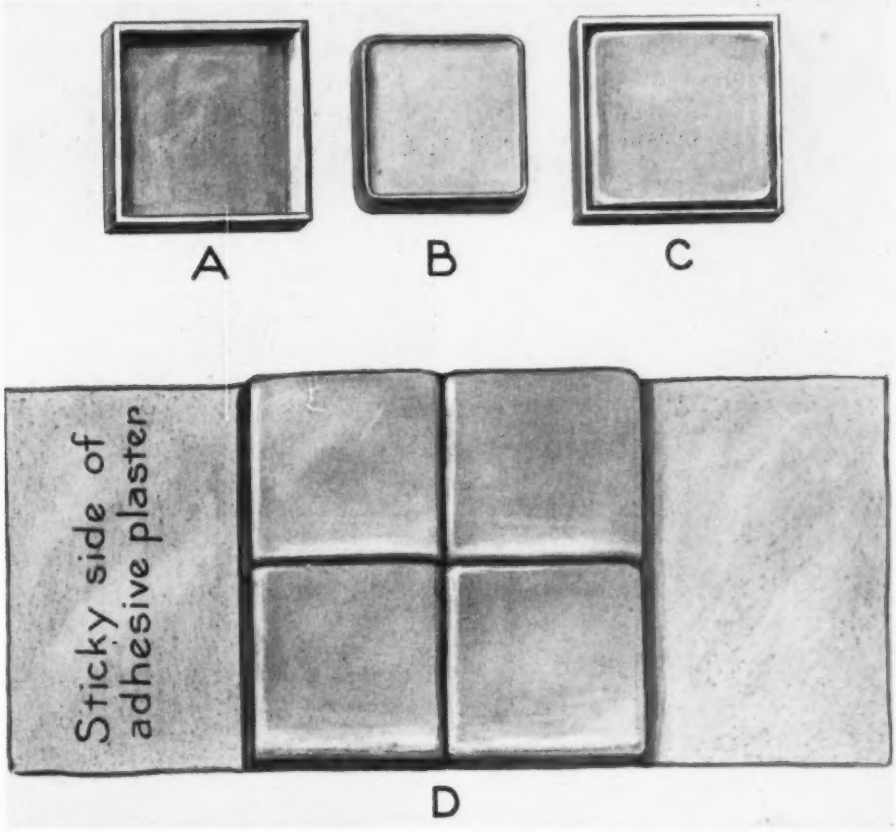

Fig. 14. (*A*) Tray-shaped brass filter, 2 mm. thick with sides 1 mm. thick. (*B*) Glazed radium plaque. (*C*) Plaque inside filter, active side down. (*D*) Group of four filtered plaques on adhesive ready for application to hemangioma.

We have never seen an injury to the eye from this technique, or in the twenty-five years the senior author has treated angiomas in babies. Kaplan,* in twenty-six years in charge of radiotherapy at Bellevue Hospital, has never seen any injury to the eye from radium treatment properly given. However, there is so much criticism of the use of radium near the eyes that it is usually simpler to treat such angiomas by

* Personal communication.

result the aim should be to avoid local cutaneous reactions. Hence the erythema dose which is obsolete in the treatment of cancer is important in the treatment of hemangiomas and some other cutaneous diseases.

Comparison of Radium with Roentgen Rays

We follow the technique advised by Pendergrass with the Philips contact roentgen-

FIG. 15 and 16. Fig. 15. At age of eight months. Before treatment. Upper lip protruded 2 cm.; right eye smaller than left. Fig. 16. At five years of age. After radium treatment with plaques by Dr. Geo. M. Mackee and author. (Reproduced by permission from Andrews. Diseases of the Skin. W. B. Saunders, Philadelphia, 1946, p. 652.)

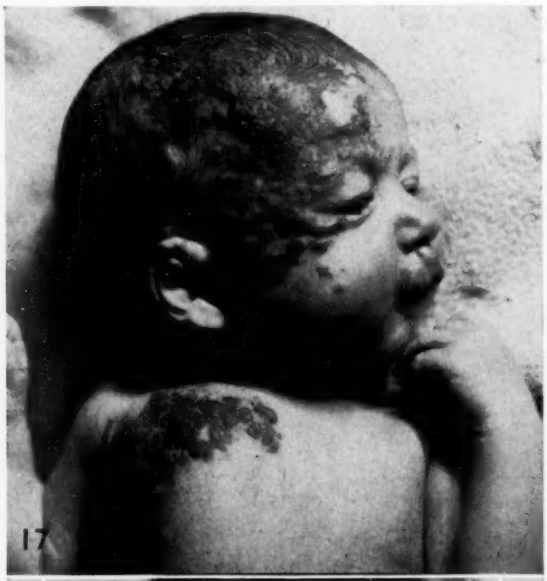

FIG. 17 and 18. At age of three months. Before treatment. Fig. 18. At age of ten years. After radium treatment with brass trays and plaques. (Reproduced by permission from Pack and Livingston. Treatment of Cancer and Allied Diseases. Paul B. Hoeber, Inc., New York, 1940, Vol. III, p. 2032.)

ray apparatus for the treatment of hemangiomas located on the lips. Using radiation filtered through 2.5 mm. of aluminum he gives 200 to 250 r at intervals of six weeks for a total of four to six doses. This technique gives a total dose of 1,000 to 1,500 r, which compares with an estimated total dose of 2,250 to 3,750 gamma roentgens from the radium applicator. In both cases the single dose is approximately three-quarters of an erythema although the total

dose is about 5 e.d. for the Philips radiation and 2.5 e.d. for the radium.

Although we obtain many excellent results in the treatment of hemangiomas by roentgen rays produced by ordinary superficial therapy machines at voltages of 50 to 120 kv. with various filters, and by contact roentgen therapy, treatment with gamma-ray plaques or trays has been more suited to the physical requirements.

CRUSTING, ULCERATION AND TENDERNESS

Crusting, ulceration and tenderness are usually signs of infection. One or more of these signs may develop spontaneously in an angioma before any treatment it started. A scratch from the fingernail, a bruise from a fall, pressure from clothing or maceration of the surface epithelium in areas adjacent to the body orifices may cause these signs. The pressure of a radium plaque on such an ulcerated infected lesion for several hours may have an adverse effect by spreading such infection or thrombosis. Once a thrombosis of some of the vessels starts it may spread rapidly and cause a large ulceration within a few days. It is better to treat such cases by penicillin injections, giving children under one year 150,000 to 300,000 units in the buttocks daily for a week or two until the crusting and tenderness have disappeared or the ulceration has begun to heal. After the infection is gone, radium is applied. It is not necessary to

Fig. 19 and 20. Fig. 19. Before treatment. Aged four months. Ear partly destroyed. Fig. 20. At age of three years. After three radium treatments with plaques and trays. Remnants have since disappeared.

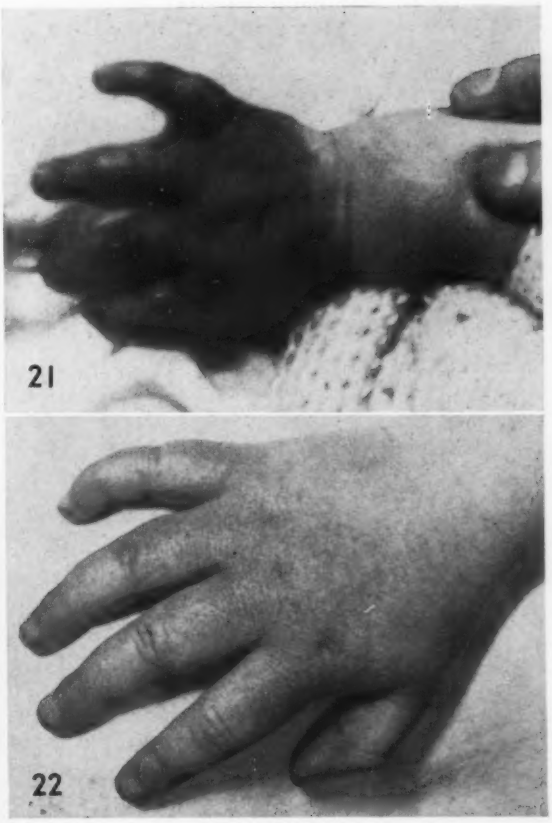

Fig. 21 and 22. Fig. 21. Angioma of dorsal aspect of hand before treatment. At age of two months. Fig. 22. After radium treatment with plaques. At age of two years.

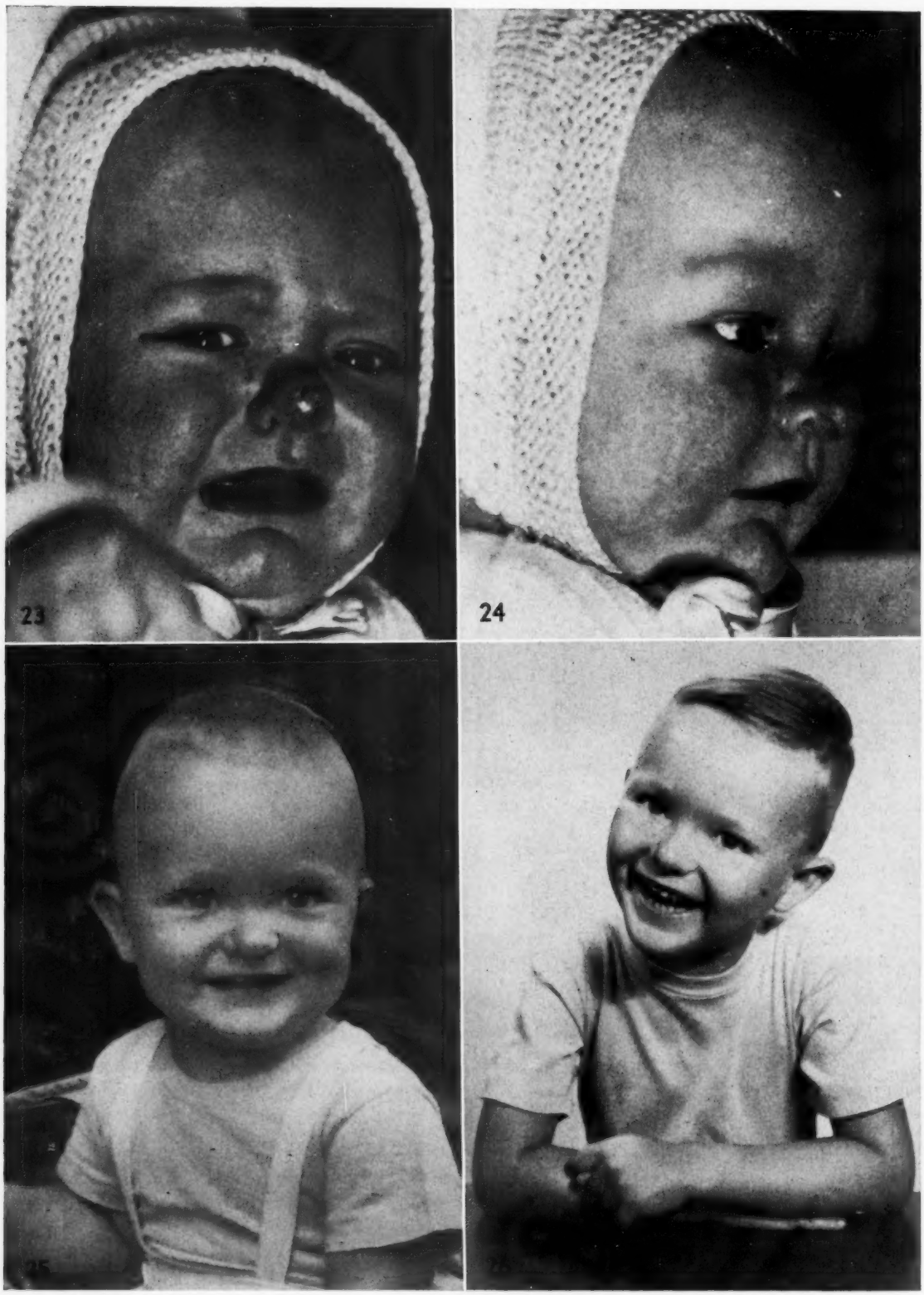

FIG. 23, 24, 25 and 26. Fig. 23. Aged two months. Bulbous angioma of nose. Before treatment. Fig. 24. Side view, before treatment. Fig. 25. Aged three years, after three radium treatments with brass tray. Fig. 26. At age of five years.

wait for the ulceration to heal completely if it is large. As long as improvement is shown, the radium treatment can be applied and the penicillin injections continued until healing has taken place. For local use, wet compresses of Burow's solution of aluminum acetate diluted 1:20 are used for a few days but after the purulent condition has somewhat subsided penicillin ointment is applied on strips of soft linen or muslin, and on the extremities this is covered by stockinette. These are changed at least morning and night, sometimes more often. Local penicillin treatment is quite useless without the injections of penicillin.

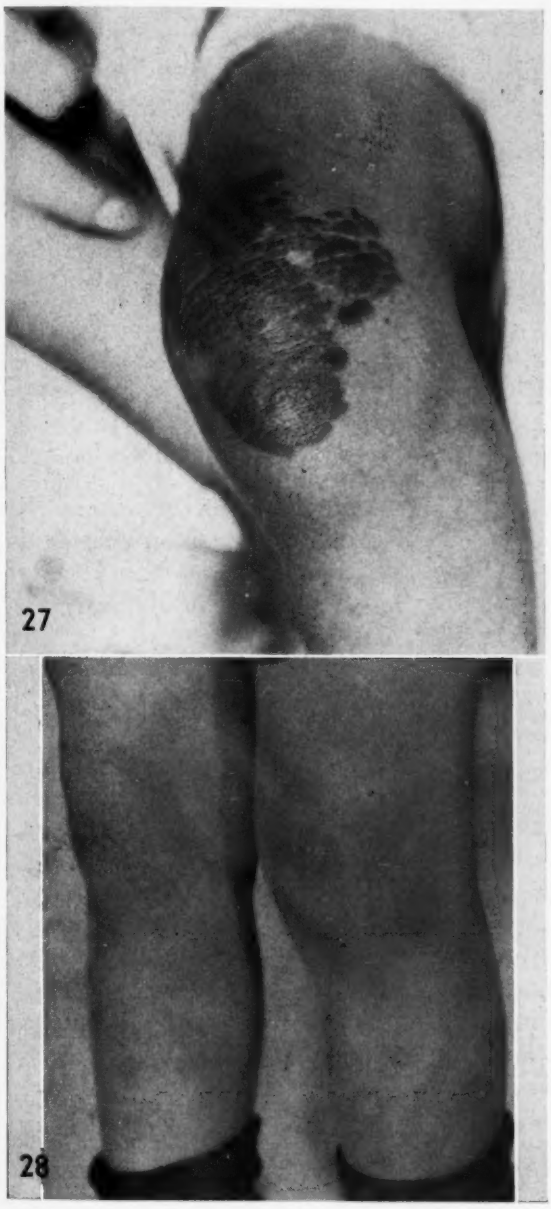

FIG. 27 and 28. Fig. 27. Hemangioma of knee before treatment by brass plaques. Fig. 28. After radium treatment with brass plaques. No disturbance of bone growth has ever been seen from this treatment.

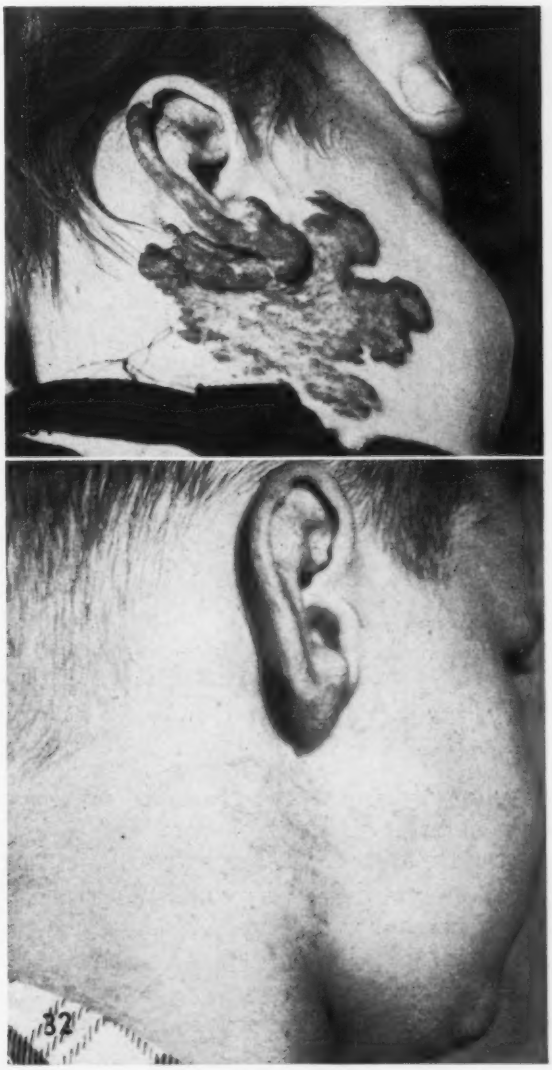

FIG. 31 and 32. Fig. 31. Angioma of ear and neck; aged two. Fig. 32. After treatment by radium plaques. Aged four. Remnants left untreated.

After radium treatment has been given, minor worries are sometimes encountered where the angiomas are very large. In such cases the pressure of the adhesive strips or scratching by the baby may cause crusts, irritation or small ulcers on spots where the radium was never applied. Any such

FIG. 29 and 30. Fig. 29. Hemangioma of ankle before treatment. Fig. 30. Five years after five treatments by radium trays. (Reproduced by permission from *Arch. Dermat. & Syph.*, 1938, *37*, 573–582 [p. 579].)

crust or ulcer deserves concern. Impetigo or a spreading ulceration apparently due to traumatic thrombosis may ensue if such incidents are neglected. Usually any crusting or traumatic ulceration is a reason for a few penicillin injections, intramuscularly, which together with penicillin ointment, locally, will heal the lesions in a week.

OTHER METHODS OF TREATMENT

The injection of sclerosing solutions was used on the majority of cases treated by the surgical department and on over 200 cases treated by the department of dermatology. The technique is well known, having first been described by the senior author in 1932.[2] This method of treatment is of particular value in angiomas of the eyelids and near the eyes, although the cosmetic results from it are not as good as those from radium treatment.

Refrigeration with solid carbon dioxide is an old method of established value. It is especially useful on small lesions or on those located where the cosmetic result is not important. The treatment causes obliterative thrombosis of the vessels in the angioma and superficial necrosis that heals with a white pliable scar and no keloidal tendency. Hemorrhage after the treatment of large hemangiomas with solid carbon dioxide may necessitate blood transfusions.

Surgical excision was performed on 81 patients, mainly by the department of plastic surgery. There was 1 death due to anesthesia and 1 near death from the same cause so that the operation had to be abandoned. Most of the angiomas that were excised were small. Some had been treated in the early days by radium implants or by techniques no longer employed and were operated upon for the removal of cicatrices and areas of radiodermatitis. Lymphangiomas were successfully excised in many instances.

CONCLUSIONS

One should not wait for angiomas to disappear spontaneously. Angiomas are likely to grow and it is better practice and very simple to treat them at once when they are first seen.

Radium treatment with gamma-ray applicators, as described, is simple, safe, and gives the best cosmetic results.

Fig. 33 and 34. Before (Fig. 33) and after (Fig. 34) radium treatment. Angioma of right upper extremity. Skin and bone growth normal seven years later.

Experience has shown that some and probably many cases of ulceration and scarring, previously ascribed to radium treatment, were due to trauma and infection, and occur upon angiomas not treated by radium and are usually healed in a week or two by the use of penicillin parenterally and locally.

We do not belittle in any way the dangers of radiation therapy but wish to emphasize that progress has been made in this as well as in other branches of medical practice. It can be said unequivocably that the radium treatment of hemangiomas has reached the point where there are no doubts as to the satisfactory cosmetic results.

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FIG. 35 and 36. Fig. 35. Angioma on lower lid and cheek before treatment. Aged ten months. Fig. 36. After three treatments by radium plaques. Eye and skin normal. Aged nine years.

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DISCUSSION

DR. HAROLD W. DARGEON, New York, New York. Dr. Andrews' very comprehensive discussion has emphasized not only the results he has obtained by several methods in the treatment of hemangiomas but also some of the controversial features concerning the management of these tumors. He has indicated the responsibility of the practitioner in their management, and as a practitioner my remarks are intended to appraise the problem as I believe it affects the pediatrician.

The immediate neonatal period of life, and that for some weeks after birth, is one in which a multiplicity of conditions resulting from disorders of fetal life, birth and neonatal adjustments are recognizable. Intrinsic fetal diseases, morbid processes in the mother or fetus, placental malpositions and birth accidents may produce disease so mild, on the one hand, as to show no clinical evidence whatever in the newborn child, or at the other extreme, so extensive as to be immediately or at some future time incompatible with life. The pediatrician who actively intervenes routinely in the deviations and disorders at this period which are often self limited, such as cephalohematoma, tonguetie, hematoma of the sternocleidomastoid muscle, or broadening of the roentgenographic shadow of the upper mediastinum, is either inexperienced or is consciously subjecting the patient to needless treatment.

The policies regarding management of any group of these conditions in which spontaneous arrest or cure might be expected in some percentage of cases are applicable also in the instance of hemangiomas.

1. *Indications for Therapy*: Any risk to the patient is unacceptable if functional impairment, deformity or significant cosmetic defect

may result from delay. Therefore, most hemangiomas about the eyelids, nares, lips, ears, genitalia, anus and joints require prompt treatment. Frequently the position and size of the tumor, the age and health of the child justify a policy of observation. The patient, however, must be observed often enough to assure the physician that deferment of treatment involves none of the risks enumerated. This may require very frequent examinations—perhaps, in unusual cases, as often as every forty-eight hours for a short period—until the trends of growth of the tumor are known. Later the frequency of examination may be limited to a semimonthly or a monthly schedule.

2. *Type of Treatment*: Once the need of treatment has been established the type of treatment is to be considered. If simple procedures achieve very satisfactory results such methods should be used initially. They are available in the form of CO_2 snow and sclerosing solutions, as Dr. Andrews and other observers have noted.

The perennial debate regarding the late effects of irradiation of the skin of infants, even with methods now considered safe, is not a field for discussion by a pediatrician. The question is raised, however, as to whether an unequivocal conclusion that such therapy involves no risk whatever is justified until a fifteen year or longer follow-up study is made on a large series of cases. It is recognized that some cases do need irradiation and surgery, too, but the decisions for such infrequently required treatment must be governed by the circumstances of the particular case.

Summary: Hemangiomas constitute only one of numerous varieties of defects occuring in infancy which may or may not require treatment. A dictum stipulating or implying that all cases of hemangioma require treatment is contrary to clinical experience.

Dr. Maurice Lenz, New York, New York. Dr. Andrews and his collaborators have carefully reviewed their experience with the treatment of nearly 900 angiomas. This study is important as the material is large, the observations sufficiently long, and the analysis thorough. Though angiomas may be obliterated by roentgen rays, radium rays and sclerosing solutions, each method has some advantages of its own. Freezing and tying off of supplying vessels will not be discussed here. Roentgen rays and radium are best in infants a year or less old, as during that period angiomas are most radiosensitive. The treatment is painless, except if interstitial radium is used. Sclerosing solutions are more likely to be chosen for angiomas in older children and adults. Roentgen rays are preferable to radium in angiomas of the eyelids, as the globe may be more readily shielded from low voltage roentgen rays than from radium. Radium plaques may be better over growing epiphyses because of the short target-skin distance. Extensive hemangiomas are more easily irradiated with roentgen rays. unless one has access to many small radium tubes or owns multiple radium plaques, as used in Dr. Andrews' "foolproof radium technique". The latter is an excellent method and is certainly adequate for the average case. Personally, I have been equally well satisfied with the use of unfiltered roentgen rays which may be 45, 60 or 80 kv., depending on the thickness of the angioma. I usually administer 1,000 r divided into four equal treatments a week apart or accasionally into two treatments one month apart, if the angioma is less than 1 cm. in diameter. If regression is slow it may become difficult to resist the temptation not to wait but to administer more than this dosage, especially when pressure is exerted by an anxious and worried parent. Additional treatment is rarely necessary if 1,000 r has been given with the proper voltage, and if a little patience is exercised. The target-skin distance with 45 kv. is 3.4 cm. and with 60 or 80 kv., 10 to 15 cm. In extensive or very deep hemangiomas, a longer distance would be used. Radium plaques, as emphasized by the authors, have the advantage of a shorter target-skin distance, yet penetrating radiation. I do not believe that the fact that a hemangioma is extensive necessarily signifies that one has waited too long. I have seen several infants a few weeks old with extensive hemangiomas, in whom procrastination could not have been responsible for the extent of the lesion.

Success in the treatment of hemangioma does not depend so much on the method one uses, as on the familiarity with the particular technique and the care and skill with which the treatment is carried out; the age of the patient, the size and location of the hemangioma influence the choice of the method as already mentioned.

I congratulate the authors for an excellent presentation of a subject which, though not new, is always timely.

RADIATION THERAPY OF MALIGNANT MELANOMA*

By PAUL H. REITMAN, M.D.
Assistant Director, Tumor Clinic, Michael Reese Hospital
CHICAGO, ILLINOIS

THE subject of radiation therapy of malignant melanoma has been a most controversial one over a period of many years. The consensus has been that wide surgical excision of the primary melanoma and radical dissection of the regional lymph nodes is the treatment of choice. Quite correctly, this opinion stems from the experience of our surgical colleagues, and there has been little to dispute it from the ranks of the radiotherapists. However, we comment that, despite the radical and often mutilating surgery, the prognosis of this entity is still the worst of all malignancies. George Pack,[9] one of the foremost advocates of radical surgery reports 17.7 per cent five year survival in early malignant melanomas with no evidence of extension beyond the local lesion. This survival rate drops to 15.6 per cent when metastases to the regional nodes are present. The total salvage rate for five year survival, however, in unselected cases falls to 9.6 per cent. De Cholnoky[5] has analyzed the statistics of various authors and has established an average of 19.2 per cent five year survival. A careful analysis of the papers of each individual author shows these cases to be highly selected. Ackerman and del Regato,[1] in their excellent text, report a high of 30 per cent five year survivals for local lesions, under 10 per cent for clinically negative but pathologically positive regional nodes, and under 5 per cent for clinically positive lymphadenopathy.

The sole purpose of this paper is to show the response of malignant melanomas to irradiation. It has been our experience that the results have been at least as favorable as in those treated by radical surgery. Our series is too small to be statistically significant, but a definite trend of results is certainly indicated. We believe that if the radiotherapist has the same opportunity to see cases as early as the surgeon, and to treat these patients adequately, the results will be statistically comparable and preferable by the avoidance of mutilating surgery.

Pigmentation is a normal component of many structures of the human body, and is the result of the ability of certain cells to elaborate the pigment, melanin. This is not restricted to any one type of cell. Pigment is found in varying quantities and distributions—the freckle, the "liver spot," the dark areola of the nipple, anal skin, choroid layer of the eye, the "Florida sun tan," and the deeper pigmentation of the Negro. This type of pigmentation is found essentially in the basal cell layer of the epidermis.

Pigmentation in a pathologic form, either benign or malignant, arises from abnormal collection of pigment cells, generally designated as nevus cells. The origin of this cell is controversial. Most recently there has been a tendency away from the neurogenic theory of its origin as first propounded by Soldan and popularized by Masson.[7] Histopathologists are returning to the explanation of an epidermal origin as described by Unna.[11] This opinion has its enthusiastic adherents in Willis,[14] Dawson,[4] and Nicholson[8] in England, and has been discussed in the recent papers of A. C. Allen[2] and Sachs, MacKee, Schwartz and Pierson[10] in this country. The nevus cell is considered to be differentiated from the basal cell layer of the epidermis by a "dropping off" process or "Abtropfung" as described by Unna. This cell has the potentiality to form melanin as can be proved by the "dopa" reaction of Bloch,[3] but it does not always do this as is evidenced by the exist-

* From the Tumor Clinic (Erich M. Uhlmann, M.D., Director), Michael Reese Hospital, Chicago, Illinois. Presented at a meeting of the Chicago Roentgen Society, February, 1950.

ence of collections of amelanotic nevus cells.

The benign form, the pigmented nevus or mole, can range from a small brown or black macule through the papule to a large warty or mammillated growth. It may or may not be hairy. It may be linear and symmetrical as in the nevus systemicus or may be segmental as in the bathing trunk type. Nevi may be scattered over any part of the body. Many individuals have at least twenty to thirty small pigmented lesions scattered over the surface of their bodies. Nevus cells lying deeper in the dermis have a blue or blue-black appearance. These are exemplified by the Jadassohn-Tièche nevus or the mongolian spot found in the sacral area of infants of the yellow race. Benign nevi can be congenital or acquired. The congenital nevus is present from birth and increases in size only proportional to the general body growth. It usually ceases to grow by puberty. We have seen some of the most extensive of these fade remarkably during the time they are under observation. The acquired mole usually appears in adult life and rarely attains any great size.

The malignant pigmented lesion, which we shall designate as malignant melanoma, may arise "de novo" or may arise from a pre-existing benign nevus. Statistics vary from 50 per cent to 80 per cent as to the incidence of this latter. In our series, we found 69 per cent arising in a preexisting nevus. Irritation or trauma undoubtedly is the most important single factor causing the transition from the quiescent benign stage to that of frank malignancy. Shaving, belt line or collar irritation, ill fitting shoes, squeezing a blackhead, or the injudicious use of caustic, cautery, or the scalpel may initiate the change to malignancy. Fifty per cent of our cases present a history of initiating trauma.

For the above reasons biopsy is obviously contraindicated. One may argue that without biopsy, complete proof that a pigmented lesion is malignant melanoma is lacking. We are of the belief, however, that the clinical diagnosis of malignant melanoma can be made. Any pigmented lesion of the skin arising "de novo," exhibiting unreasonable growth, pigment change, satellite formation, erosion, bleeding and/or ulceration, or any pre-existing pigmented lesion exhibiting similar changes should be considered malignant. Admittedly, the diagnosis is not simple and other pigmented tumors of the skin must be ruled out. The lesions that must be differentially diagnosed are keloids in children following inconsequential trauma, seborrheic warts, pigmented papillomas, neurofibromatosis of von Recklinghausen, Bowen's dermatosis, pigmented basal cell and squamous cell epitheliomas, hemorrhagic vesicles, and even the sebaceous cyst. The case history is most important, the majority of melanomas arising in pre-existing nevi. The rapid growth and tendency toward early metastasis differentiates this lesion from the pigmented epithelioma. The familial history of neurofibromatosis may be helpful in differentiating it from malignant melanoma. The excision biopsy of a metastatic gland or nodule is not contraindicated and may be the only method of establishing a diagnosis in some cases.

Malignant melanomas are most frequently observed beyond the fourth decade. The average age in our group was 43.3 years; the mean age, coincidentally, is approximately the same, 43.5 years. It was noted that the average and mean age of the group surviving was significantly lower than the group not surviving. This was due to the fact that the survival group contained 4 cases from five months to ten years of age. The incidence of malignant melanoma in children is extremely low, and when it does occur before puberty, the prognosis is relatively favorable even with regional node metastases.

Distribution according to sex in our series differs somewhat from other reported cases. It is generally assumed that melanomas are equally distributed between male and female. Our series show a preponderance of females in the ratio of 26:16. It may be of interest that the females predominate the survivors 15:6, while the males predominate the failures 11:10.

The change in thinking as to the origin of the nevus cell may alter somewhat certain "philosophies" held in the treatment of malignant melanomas since it has been the theory of the neurogenic origin of melanomas that has tended to restrict the use of irradiation, neurogenic tissue being classified as one of the most resistant to roentgen rays and gamma radiation. It has been our clinical experience that the malignant melanomas are radioresponsive and we consider it important enough to include this modality in their therapy.

In the past eight years, 42 cases of malignant melanomas were treated in the Tumor Clinic of Michael Reese Hospital. These have fallen into two groups of equal numbers, 21 who are surviving (Fig. 1), and 21 with fatal termination (Fig. 2). One of the surviving patients has multiple metastatic nodules but these lesions have remained quiescent thus far following radiation therapy. The other patients are alive without evidence of active pathology for periods ranging from three months to eight years.

In our group of survivals, the diagnosis was established clinically, based on the criteria discussed in preceding paragraphs, in 8 patients; in the remaining 13 patients, the diagnosis was established by microscopic sections. All cases terminating fatally were proved pathologically. All our cases were classified in four stages, characterized as follows: Stage I, a purely local lesion; Stage II, infiltrative spread or satellitosis; Stage III, regional lymph node metastases; Stage IV, distant metastases. Perhaps the most significant fact in our series is that, in those who have survived, 57 per

PATIENTS SURVIVING WITHOUT EVIDENCE OF ACTIVE PATHOLOGY
JANUARY 1950

SURVIVAL PERIOD MOS. 3	4	6	9	YEARS 1	1.5	2	3	4	6	8	AGE	SEX	DIAG. Clin.	Path.	TYPE Cong.	Acqu.	LOCATION Head Neck	Upper Ext.	Trunk	Lower Ext.	STAGE I	II	III	IV	TRAUMA OR INADEQ. SURGERY	THERAPY Rad. Only	Pre-Op.	Post-Op
AW											69	F																
	PL										43	F																
		SB									40	F																
			JR*								41	M																
				JB							39	M																
					CK						55	M																
					M6						5mo	F																
						HS					60	M																
						RB					35	F																
						FM					30	F																
							DS				46	F																
							RK				3	M																
							MW				52	F																
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								KC			71	F																
								DL			14	F																
								AE			27	F																
									EK		10	F																
									RS		21	M																
									SK		55	F																
										BG	10	F																
Tot	1	1	1	1	1	2	3	3	4	3	1	M 6	F 15	8	13	18	3	3	3	4	11	12	3	4	2	6	10	7	7**
%										100		M 29	F 71	38	62	86	14	14	14	19	52	57	14	19	10	29	48	33	33

* Evidence of disease present but quiescent since therapy.
** Two cases received both preoperative and postoperative irradiation; 1 case received radiation alone to new metastatic nodules and postoperative irradiation to previously excised areas.

FIG. 1

cent were Stage I. In our group of fatalities only 4 per cent were Stage I, while 43 per cent each fell in Stages III and IV. Thus, much of the therapy in this latter group was palliative and could not be directed with an attempt to cure.

As found elsewhere, the majority of our cases, 52 per cent, originated in the lower extremities.

We believe that the effective carcinocidal dose for malignant melanoma lies between 5,000 r gamma and 8,000 r gamma. We should prefer about 7,000 r gamma in the larger fields, and 8,000 r gamma for smaller areas. We have been successful in obtaining this high dosage over single fields by the use of radium element; a surface plaque was used for the smaller localized lesions; a telecurie therapy apparatus, in the form of a 4 gram radium "bomb," was used for the irradiation of larger areas and for metastatic regional lymph nodes. We have rarely used roentgen radiation since the reactions in the corresponding dose range are disproportionately too severe and we favor the fractionation and protraction more easily achieved with radium therapy. To deliver the 7,000 r gamma with a 4 gram "bomb" twenty successive treatments of one hour each are necessary, since the "bomb" in the technique employed by us delivers 333 r gamma per hour or per 4,000 mg. hr. For delivery of 8,000 r gamma by means of surface radium plaque, we use a 2 cm.^{2} plaque containing 100 mg. of radium, with equivalent filtration of 0.75 mm. of platinum, at 1 cm. distance. With such a plaque 507 r gamma is delivered each hour or per 100 mg. hr. Four daily four-hour treatments are necessary to deliver the required dose. If the lesion demands treatment over a larger area, adequate adjustment in the technique of application must be made. With the dosage described we have seen lesions regress or at least become quiescent. This amount of radiation is not excessive

SURVIVAL of PATIENTS with FATAL TERMINATION

SURVIVAL PERIOD (mos.)	AGE	SEX	DIAG.		TYPE		LOCATION				STAGE				TRAUMA OR INADEQ. SURGERY	THERAPY		
3 4 5 7 9 10 14 15 19 20 22 24 27 28 30 48 49 108 192			Clin.	Path.	Cong.	Acqu.	Head Neck	Upper Ext.	Trunk	Lower Ext.	I	II	III	IV		Rad. only	Pre-Op.	Post-Op.
RP	35	M																
FS ← Cases lost to follow up	47	M			primary undetermined													
SJ	63	F																
VL	60	M																
SS	40	M																
HR	65	M																
AE	52	F			primary undetermined													
LB	28	M																
SP	27	F																
DC	48	M																
JR	70	F																
TK	36	F																
MI	45	F																
JR	8	M																
SW	27	F																
JT	36	M																
AW	53	M																
NE	54	F																
LS	46	F																
MT	37	F																
MM	57	M																
TOTAL CASES : 21	M-11	F-10	0	21	11	8	4	0	4	11	1	2	9	9	15	3	0	21*
% : 100	M-52	F-48	0	100	52	38	19	0	19	52	4	10	43	43	71	14	0	100

* Three cases received irradiation alone to metastatic nodes and postoperative irradiation to areas from which primary had been excised.

FIG. 2

and does not cause tissue cauterization.

Since our survivals in the fifth year or more at this time represent 19 per cent of all our cases, and since the prospect of obtaining a still more favorable figure in the next two years is a fair one, we would prefer to wait before making any definite statement as to our final statistics. I do not believe we are overly optimistic since these patients have had the advantage of early diagnosis, have, in most instances, locally limited lesions, and have had adequate therapy. It is of interest to note that 15 of the 21 non-surviving patients were dead within two years. This is an indication of the far advanced condition of these patients when first seen by us. We must beware of false security on this point, however, since 2 of our patients present a history of new activity after a period of quiescence of twelve and nine years respectively following the initial therapy (not irradiation). This is not unusual for malignant melanomas.

It would be opportune here to emphasize the important differences found in these two groups, 21 of whom are surviving and 21 of whom did not survive. The most important single factor, as stated, is that most of the survivals fall in Stage I (57 per cent). These patients were seen early, treated early, and treated adequately. Also of significance is that only 6 of the surviving group present a history of trauma or surgical "interference," such as inadequate excision, cautery, or fulguration; 15 of the non-surviving group do present such a history.

To illustrate some of the significant facts, we present the following case reports. These have not been selected for their good results, but to emphasize the problems occurring in the treatment of malignant melanomas.

CASE REPORTS

CASE I. B. G., a ten year old female, was first seen in the Tumor Clinic in 1936. At that time, she received radium plaque applications to a pigmented spot on her right buttock. The rationale of this therapy was not explained in the records, since the history, as recorded, indicated no evidence of malignancy. The spot had been present since birth, had exhibited no unreasonable growth nor color change. In addition, the dose delivered (600 mg. hr. and 300 mg. hr. at monthly intervals, a total dose of approximately 4,000 r gamma) seems inadequate for malignant melanoma.

The patient was next seen five years later in 1941. Examination at that time revealed a blue-black circular lesion on the right buttock which was ulcerated and crusted. It had increased in size since the time of the initial examination. A group of firm, enlarged lymph nodes was palpable in the right inguinal region. One of these was excised and on microscopic section proved to be metastatic malignant melanoma.

The patient received 8,000 r gamma to the primary lesion and to the groin. Tissue response was adequate. The primary lesion healed and the metastatic lymph nodes regressed as evidenced on examination three months later. The patient remains alive and well.

Comment. This case is presented as an eight year survival from the time of adequate therapy of a Stage III malignant melanoma. It is possible that inadequate irradiation in 1936 served as a trauma initiat ing malignant change in what was, as far as we could determine, a benign pigmented lesion of the skin.

CASE II. J. N., an eight year old male, was first seen in the Tumor Clinic in August, 1938, with a dark brown pigmented area occupying the entire left buttock. This had been present since birth but had grown disproportionately to the rest of the body, and two years previous to his admission nodules had developed in the left inguinal region. Removal at another hospital had shown these to be metastatic malignant melanoma.

Examination at this time revealed an extensive pigmented lesion of the left buttock with considerable hair growth. Numerous satellites were present around the primary lesion. There was a surgical scar in the left groin and a group of palpable, firm, enlarged lymph nodes. These appeared through the overlying skin with a bluish discoloration.

The patient was treated over the inguinal region palliatively, receiving 3,500 r gamma. The lymph nodes decreased in size with this small dose and remained quiescent for two

years. In 1940, the patient was lost to follow-up. He is considered as a non-survival as of that time.

Comment. This case is presented because of the unusual circumstance of a segmental nevus demonstrating malignancy. This type of nevus, especially if hair is present, rarely becomes malignant. Palliative therapy was given, and the metastatic lymph nodes regressed, demonstrating a degree of radioresponsiveness not usually admitted. The dose, however, was not adequate for permanent regression according to our belief; we have no further information after the patient was lost to follow-up.

Case III. M. M., male, aged fifty-seven, was first seen in the Tumor Clinic, in August, 1945, with a history that twelve years before, a toe of the right foot had been amputated for malignant melanoma. Several years previous to his admission here, he developed cervical lymph nodes which were negative for neoplasm on microscopic examination. Four months previous to his admission here, he developed palpable lymph nodes in the right groin. These were removed by Dr. George Pack, but were also negative for malignancy on microscopic study. The patient, however, developed shortness of breath and pleural effusion. Roentgenograms showed pulmonary metastases.

The patient did not respond to palliative therapy and ran a retrogressive course; he died eight months after he was first seen in our department. He represents, nevertheless, a 152 month survival from the time of his first definitive treatment.

Comment. This case illustrates the caution to be observed in drawing conclusions from the accepted five year survival. While this is not a frequent occurrence, it cannot be considered rare:

Case IV. E. K., female, aged ten, was first seen in the Tumor Clinic, in April, 1943, with a history of a pigmented congenital nevus on the left forearm. Recently the lesion had grown and two satellite lesions appeared at its periphery. Because of the growth of the primary lesion and the appearance of the satellite nodules, the clinical diagnosis of malignant melanoma was made and the patient treated accordingly.

She received 6,500 r gamma to the lesion which regressed in due time. Five months later the residual pigmented area was excised adequately. On microscopic section, only a diagnosis of nevus cells could be made.

Comment. We present this case as one of our clinical diagnoses that was not confirmed on microscopic section. We hold, however, to our original diagnosis, since the clinical course of malignancy cannot be denied. Benign pigmented lesions do not show growth nor the formation of satellites. It is not at all unusual to encounter difficulty in deciding as to the benignity or malignancy of a suspected pigmented lesion on microscopic section. Qualified histopathologists may differ as to the proper interpretation.

The following 2 cases are of interest in that they represent the incidence of malignant melanoma in siblings.

Case V. M. T., female, aged thirty-seven, was first seen in the Tumor Clinic, in August, 1944, with the history of a pigmented congenital nevus removed from the right shoulder nine years previously. Five years previously a second congenital nevus was removed from her left ankle. There was no suspicion of malignancy at the times of surgery and no microscopic studies were made. Several months before her admission here, the patient noted a "swelling" in her right groin.

Examination revealed surgical scars on the right shoulder and right ankle. Enlarged hard nodes were palpable in the right femoral region, both groins, and pigmented nodules were present in the skin of the back and right shoulder. A large tumor mass was present intra-abdominally about the size of a seven month pregnancy. The patient was dyspneic. A roentgenogram showed pulmonary metastases.

Palliative therapy was of little benefit and the patient died two months after we first had seen her. Autopsy revealed metastases in the skin, heart, lungs, liver, spleen, pancreas, right kidney, right suprarenal gland, ovaries, and inguinal lymph nodes.

Comment. This case demonstrates the long period of quiescence that may follow local excision, even if inadequate. Also it demonstrates the "prolific impartiality"[13]

that characterizes the metastases of malignant melanoma.

CASE VI. The sister of Case V, R. B., aged thirty-five, understandably aware of all the signs and symptoms of malignant melanoma, was seen in the Tumor Clinic in April, 1948, following trauma to a "birthmark" on the anterior aspect of the left lower leg. This injury had caused the nevus to ulcerate and increase in size. In addition, there was an amelanotic nodule in the right upper arm about the size of a dry pea.

Eight thousand r gamma was delivered to each involved area and the lesions showed regression. However, the primary lesion on the left leg did not heal completely and was excised widely. In the area exposed directly to radium, no malignant cells were found on microscopic examination. However, groups of metastatic cells were observed in the adjacent areas. This patient has remained well.

Comment. We present this case to demonstrate the rapidity of spread before therapy and also microscopic proof of complete regression in an adequately treated area.

CASE VII. D. C., male, aged forty-eight, was first seen in the Tumor Clinic in November, 1944, five weeks after a tumor mass removed from the right groin proved to be metastatic malignant melanoma. There was no evidence of a primary lesion at this time.

The patient received 5,000 r gamma to the operative site, but three months later, the nodes were still in evidence. One year later, the patient developed a right-sided exophthalmos and double vision. The clinical diagnosis of primary malignant melanoma of the eye was made. This was proved on enucleation. The patient did not respond to subsequent palliative therapy and metastases developed in the other eye and in the right orbit. He ran a retrogressive course and died eighteen months after the first metastatic nodule had been diagnosed.

Comment. We present this case, characteristic of intraocular malignant melanoma, where the primary lesion was only discovered after metastases had occurred.

We have had 2 cases in our series of Stage IV malignant melanomas where the primary lesion could not be determined even on postmortem examination. One is of special interest since the first positive finding was destructive lesions in the cervical spine. Metastases to bone from malignant melanoma rarely occur.

SUMMARY AND CONCLUSION

We have presented for analysis forty-two cases of malignant melanomas seen over a period of fourteen years in the Tumor Clinic of Michael Reese Hospital. One-half of these patients survive today for periods ranging from three months to eight years after adequate therapy. This has consisted of irradiation alone in nine cases, preoperative irradiation in seven cases, and postoperative irradiation in seven cases, two cases having received both preoperative and postoperative irradiation, and one case having received irradiation alone to new metastatic areas and postoperative irradiation to areas previously excised.

Surgery was done by many different individuals and a variety of techniques was employed, consisting mostly of various extents of local excision. In only one case, where the primary lesion was on a toe, was the treatment amputation with a prophylactic block dissection of the inguinal lymph nodes.

Those patients who did not survive present these essential differences. They were of the more advanced stages and thus the radiation therapy, for the most part, could be palliative only. They presented a greater incidence of pre-existing trauma. They comprised on the whole the older age group.

Williams[12] of the Cardiff Royal Infirmary aptly reflects our attitude in the treatment of malignant melanomas: "Many [malignant melanomas] are radiosensitive to a full 'carcinoma lethal dose.' Radiotherapy has a much wider scope in the treatment of malignant melanomata than its limitation to advanced or inaccessible tumors."

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RADIUM THERAPY FOR CANCER OF THE CERVIX UTERI WITH A NEW TYPE OF COLPOSTAT

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IN A previous publication[1] we described the plan of radiation therapy for cancer of the cervix uteri employed at the Mount Sinai Hospital. This plan was designed to deliver a cancerocidal dose to the cervix, the lower uterine segment, the vaginal vault, the paracervical triangles, and the lateral parametria. In this article, we shall elaborate further on the radium system.

In order to evaluate our method of therapy we chose six points in the pelvis, each point being representative of an anatomical location or structure in which the radiation dose is critical from two aspects: The first is adequate irradiation for destruction of the tumor, and the second is limited irradiation because of the limit of tolerance of normal tissues. For convenience of reference these points are identified by the letters A, B, C, V, R, and F and are located as follows: All the points, with the exception of Point C, are measured from

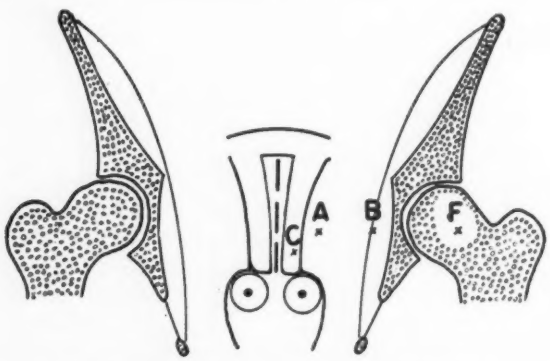

FIG. 1. Representative points in the pelvis in the transverse plane.

the axis of the uterus in a plane 2 cm. above the vaginal vault (Fig. 1 and 2).

1. Point A, in the paracervical triangle, 2 cm. laterally from the uterine axis.
2. Point B, in the lateral parametrium, 5 cm. from the uterine axis.
3. Point C, in the cervix, 1 cm. laterally from the cervical canal and 1 cm. above the vaginal vault.
4. Point V, in the posterior wall of the bladder, 2.5 cm. from the uterine axis.
5. Point R, in the anterior wall of the rectum, 2.5 cm. from the uterine axis.
6. Point F, in the head of the femur, 10 cm. from the uterine axis.

Points A and B were originally described by Tod and Meredith.[3] Point C is representative of the cervix itself. Point V lies just above the ureteric ridge in the posterior wall of the bladder where radiation reactions and injuries may occur. Point R is situated 7 to 10 cm. from the anus. Point F is of little interest in radium therapy but of great importance if multiple field roentgen therapy is employed.

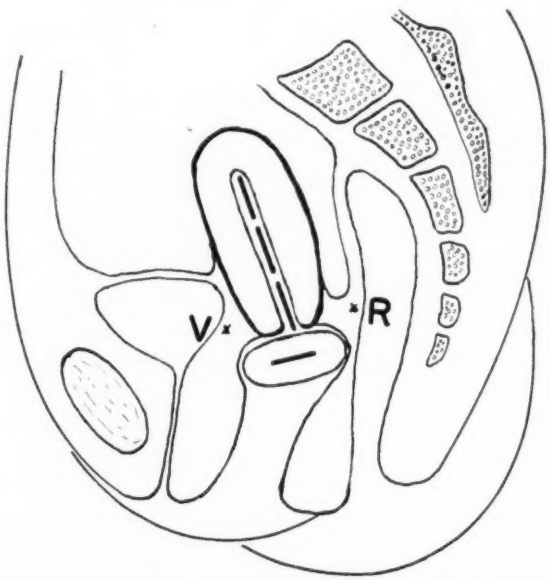

FIG. 2. Representative points in the pelvis in the sagittal plane.

The radium system consists of a linear

source in the uterus, the *intrauterine tandem*, and two unit sources in the vagina, the *colpostat*. The method to be described is the standard which we attempt to attain in every case, but deviations from this standard are occasionally necessary because of anatomical variations, especially those produced by the disease process itself.

The linear source consists of three capsules of radium arranged as a tandem in a rubber or plastic tube. The over-all active length of this tandem is 6 cm., which just fits the average size uterine cavity. The tandem contains 40 milligrams of radium and it is made up of one 10 mg. and two 15 mg. capsules of radium, the weaker source being placed at the cervical end. The tandem is inserted into the uterine cavity after dilation of the cervix and it is held in position with a suture through the anterior and posterior cervical lips. In addition, the vaginal vault is distended with gauze packing which is impregnated with balsam of peru to counteract foul odors. The gauze packing serves as an additional safeguard against the tandem slipping out of the uterus if the sutures through the cervix do not hold, and it also prevents the vaginal mucosa from coming into contact with the projecting end of the tandem. The tandem is kept in place for ninety hours or a total dose of 3,600 milligram hours. The primary filtration of the radium capsules is 1.0 mm. of platinum. The doses delivered at the six representative points from the intrauterine tandem alone were calculated in gamma roentgens[2] and are shown in Table 1.

The vaginal application of radium consists essentially of a unit source of radium in each lateral fornix. The unit radium source, in the form of a single capsule or tube of radium, is placed in an ovoid in such a manner that it lies in the longitudinal axis of the ovoid with the midpoint of the radium at the midpoint of the longitudinal axis. The shape of the ovoid has been made to approximate the isodose surface from a short linear source of radium, so that the intensity of radiation at every point on the surface of the ovoid is the same, except at the poles where the intensity is less. Radiation "hot points" are thereby eliminated. Mathematically, the ovoid may be described as an ellipse of revolution, with the isodose curve as the ellipse and the short linear radium source as the axis of revolution. Therefore, for the accurate calculation of dose, it is essential that the radium tube be correctly placed in the longitudinal axis of the ovoid. The transverse diameter of the ovoid, measured in the plane at right angles to the longitudinal axis at the midpoint, is 2 cm. The minimum distance between the vaginal mucosa in contact with the ovoid and the

TABLE I

DOSE IN GAMMA ROENTGENS

Representative points in pelvis	Dose from intrauterine tandem (3,600 mg. hr.)	Dose from complete radium system (8,400 mg. hr.)				
		Separation of vaginal radium sources				
		2 cm.	3 cm.	4 cm.	5 cm.	6 cm.
Point A—Paracervical triangle	4,000 r	6,500 r	6,500 r	6,400 r	6,250 r	6,050 r
Point B—Lateral parametrium	900 r	1,850 r	1,900 r	2,000 r	2,150 r	2,300 r
Point C—Cervix	7,700 r	13,750 r	13,000 r	12,150 r	11,250 r	10,500 r
Point V—Base of bladder	2,800 r	4,800 r	4,600 r	4,500 r	4,300 r	4,100 r
Point R—Anterior rectal wall	2,800 r	4,800 r	4,600 r	4,500 r	4,300 r	4,100 r
Point F—Head of femur	230 r	500 r	500 r	510 r	530 r	550 r
Ratio of dose at point B to dose at point A		0.28	0.29	0.31	0.34	0.38

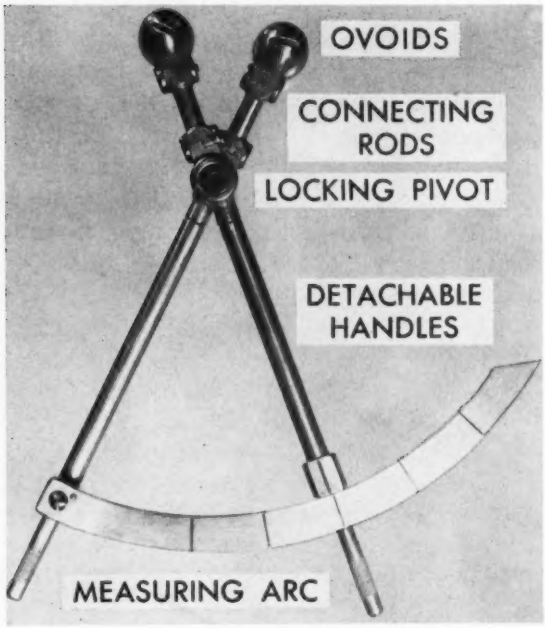

FIG. 3. Colpostat, completely assembled.

center of the radium is therefore 1 cm. One ovoid is placed in each lateral fornix. The application of the ovoids to the lateral fornices must be done under direct vision, so that their position in relation to the cervix can be observed and properly adjusted. The adjusted positions of the ovoids must then be maintained throughout the entire treatment period by the method which does not permit shifting or displacement. The dose contributed to each representative point in the pelvis by the vaginal radium can be calculated only if the exact position of each ovoid is known.

The difficulty encountered with spring type colpostats is the variation in position which occurs when the vaginal tissues relax under the constant tension of a strong spring. If a weak spring is used, insufficient lateral separation of the radium results. With other types of colpostats there may be difficulty in visualization of the position of the radium because of the bulkiness of the instrument. Other instruments lack sufficient flexibility to adjust to distortion of the vaginal vault resulting from the disease process itself. To overcome these objections, we have designed a colpostat which permits, under direct vision, accurate application of a radium source in each lateral fornix and which holds these sources firmly in place for the entire duration of the treatment.

Our colpostat (Fig. 3 and 4) consists of two ovoids which contain the radium and which are attached by connecting rods to a locking pivot piece. Manipulation of the colpostat is accomplished by two detachable handles. The exact distance between the radium capsules is measured by a calibrated arc which may be slipped on to the ends of the handles.

The ovoids can be made in various sizes to accommodate radium capsules of different lengths, but they are all 2 cm. in the transverse diameter which is in the plane at right angles to the midpoint of the linear source. A hollow cylinder within the ovoid in its longitudinal axis is of just sufficient size to hold a capsule of radium. In this way, distortion of the isodose surface due to shift in the centering of the radium source is eliminated. The cylinder is capped by a smooth fitting screw at each end. Our ovoids are made of aluminum and the wall thickness at the level of the transverse diameter measures 7 mm. With a radium capsule of 1.0 mm. platinum filtration, the gamma radiation through this thickness of aluminum is reduced by 7 per cent, according to direct

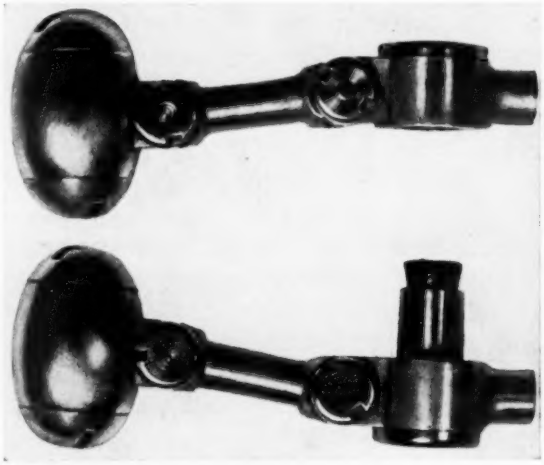

FIG. 4. Ovoids with connecting rods and separated center piece.

measurements by our physicist, Dr. Robert Loevinger. The smooth, rounded contour of the ovoids greatly facilitates their insertion into the vagina and their placement, without trauma, in the lateral fornices, especially when the vault of the vagina is distorted by disease.

The locking pivot piece consists of two rings placed one above the other. In the center of the lower ring there is fixed a slotted sleeve which projects upwards into the hollow of the upper ring. A tapered screw fits into this slotted sleeve. When this tapered screw is tightened, it wedges into the slotted sleeve, expanding it, and thereby locking the upper ring onto the lower ring by friction. The tapered screw does not project over the top of the upper ring. There is a hexagonal socket in the head of the screw to accommodate an Allen wrench to tighten or loosen it.

The connecting rods are attached to the rings of the pivot piece, one to each ring. The handles are similarly attached to the rings of the pivot piece so that, if the rings were separated, there would be two units, each unit consisting of one ovoid, one connecting rod, one ring, and one handle. The two units pivot through the locking pivot piece. The ovoids are approximated or separated by manipulating the handles. The actual distance between the longitudinal axes of the ovoids and, hence, the radium, can be measured by a calibrated arc slipped over the ends of the handles. An abutment on the end of the right handle has an indicator groove for accurate reading.

In actual practice, the instrument is completely assembled before loading with radium and before sterilization. The tapered screw is tightened sufficiently to provide moderate resistance. The friction-expansion type of lock can be adjusted to permit relatively easy pivot action and yet have enough frictional resistance to hold the ovoids in any position of separation. After the instrument is assembled and adjusted, the ovoids are loaded with radium and the entire apparatus sterilized. The ovoids can be loaded or unloaded quickly and easily and with minimum exposure to the technician by the use of a long handled screw driver and screw cap holder.

The patient is placed in the lithotomy position and the cervix and vaginal vault exposed with spades and inspected. A good light is necessary. The spades are withdrawn and the ovoids inserted into the vagina. In most patients, the introitus is large enough to permit the insertion of both ovoids together. Occasionally, the introitus is too narrow. It is then necessary to loosen the tapered screw, separate the colpostat into its two units and insert each ovoid separately. The two units are then brought together at the pivot piece and the tapered screw tightened again with the Allen wrench. After the ovoids are inserted into the vagina, the spades are reapplied and held by an assistant. The operator can adjust the ovoids into position in the lateral fornices under direct vision. The desired degree of spread is obtained by manipulating the handles. The position of each ovoid relative to the cervix is observed and the distance between the ovoids is measured with the measuring arc. Finally, a small piece of gauze is packed into the vagina above and below the connecting rods and center pivot piece to maintain the colpostat in a central position and to displace the bladder and rectum. Both handles are detached by unscrewing them from the pivot piece. On rectal examination, each ovoid is easily palpated and its position relative to the cervix checked.

During the period of application of the colpostat, the patient is kept in bed. There is very little discomfort, and catheterization of the bladder is rarely necessary. A roentgenogram of the pelvis (Fig. 5) shows the colpostat in position. Daily roentgenograms in both the anteroposterior and lateral positions have shown no shift in the position of the instrument. Before the colpostat is removed, a check measurement of the separation of the ovoids is made with the measuring arc, and in our experience the degree of separation has remained constant throughout the period of treatment.

For removal of the colpostat, the patient is again placed in the lithotomy position, the handles are re-attached, and the packing is removed. The ovoids are then brought together by the handles and the instrument withdrawn.

We have experimented with the use of this colpostat for over three years, not only in the treatment of cancer of the cervix but also in other conditions requiring radium in the lateral vaginal fornices, such as cancer of the corpus uteri, ovary, vagina, and urinary bladder. The instrument has proved to be highly satisfactory and practical.

FIG. 5. Roentgenogram of pelvis with colpostat in situ.

With the use of this colpostat in the treatment of cancer of the cervix, it is possible to calculate the dose delivered to the six representative points in the pelvis, with varying degrees of separation of the vaginal radium. We usually place a 25 mg. capsule of radium with a filtration of 1.0 mm. of platinum in each ovoid. The time of application is ninety-six hours for a total of 4,800 milligram hours. The minimum separation of the vaginal radium sources, with the ovoids in contact, is 2 cm. Usually we try to get at least 4 cm. separation. Very rarely is it possible to exceed 6 cm. separation. The calculated doses are shown in Tables I and II. A study of these tables shows that the degree of separation of the vaginal radium sources does not appreciably influence the final dose in the paracervical triangle (Point A). On the other hand, the dose to the lateral parametrium (Point B) is significantly improved as the separation of the ovoids increases. This improvement in dose (Table II) is due entirely to the more favorable geometrical positions of the vaginal radium sources. Of even greater significance is the ratio of the dose in the lateral parametrium to the dose in the paracervical triangle, a ratio which increases from 0.28 to 0.38, or roughly,

Table II

DOSES IN GAMMA ROENTGENS

Representative points in pelvis	Dose from colpostat (4,800 mg. hr.) Separation of radium sources				
	2 cm.	3 cm.	4 cm.	5 cm.	6 cm.
Point A—Paracervical triangle	2,500 r	2,500 r	2,400 r	2,250 r	2,050 r
Point B—Lateral parametrium	950 r	1,000 r	1,100 r	1,250 r	1,400 r
Point C—Cervix	6,050 r	5,300 r	4,450 r	3,550 r	2,800 r
Point V—Base of bladder	2,000 r	1,800 r	1,700 r	1,500 r	1,300 r
Point R—Anterior rectal wall	2,000 r	1,800 r	1,700 r	1,500 r	1,300 r
Point F—Head of femur	270 r	270 r	280 r	300 r	320 r

from one-fourth to more than one-third, as the vaginal radium separation increases from 2 cm. to 6 cm. Also of importance is the corresponding reduction of the dose to the bladder and rectum (Points V and R). From this analysis one may conclude that with a vaginal radium separation of 6 cm., it would be safe to increase the total radium irradiation by at least 10 per cent, thereby improving the dose in the lateral parametrium while not exceeding the limits of tolerance. The dose to the cervix itself (Point C) is high, but experience has shown that the cervix can tolerate high doses. On the other hand, the dose to the head and neck of the femur (Point F) is very low. We must therefore conclude that the radium therapy does not play any significant role in radiation injuries of the femoral neck. The dose to the vaginal mucosa, where it is in contact with the ovoids in the lateral fornices, is of the order of 17,000 r. However, the tolerance of the vaginal mucosa in this region is very high.

A particularly valuable feature of our colpostat is that the ovoids can be separated to the maximum permitted by the tissues of the vaginal vault, so that the maximum possible radium dose to the lateral parametria may be delivered.

SUMMARY AND CONCLUSIONS

1. The technique of radium therapy for cancer of the cervix uteri as employed at the Mount Sinai Hospital is described.

2. There is also described a new type of colpostat which makes possible the accurate placement and maintenance of radium in the vagina.

3. Six points in the pelvis are described as representative of an anatomical location or a pelvic structure where a calculation of dose is critically important.

4. The significance of the doses at the six representative points is discussed.

5. The advantage of our new type of colpostat in obtaining the maximum possible radium dose in the lateral parametria is discussed.

Sidney M. Silverstone, M.D.
945 Fifth Ave.
New York 21, N. Y.

ADDENDUM

On the basis of increased experience with the colpostat we are planning to simplify the construction by eliminating a few seldom used adjustment screws.

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3. Tod, M. C., and Meredith, W. J. Dosage system for use in treatment of cancer of uterine cervix. *Brit. J. Radiol.*, 1938, *11*, 809–823.

THE AMERICAN JOURNAL OF ROENTGENOLOGY, RADIUM THERAPY AND NUCLEAR MEDICINE

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Thirty-fourth Annual Meeting: Stevens Hotel, Chicago, Ill., June 8, 9 and 10, 1952.

EDITORIAL

THE RETICULOSES

DURING the past two decades increasing attention has been paid to the exceedingly complex problem of reticuloses and a vast literature has accumulated on the various phases of the subject.

Owing to the fact that so much in this field is controversial and uncertain, repeated attempts have been made to correlate the available data and arrive at some definite conclusions. Recently, two excellent symposia have been arranged with such purpose. The one, entitled "The Reticuloses," was held in three sessions at the British Institute of Radiology, on January 18 and 19, 1951. The other, bearing the title of "Lymphogranuloma, Lymphosarcoma and Reticulosarcoma," was presented as the main topic at the Annual Meeting of the Swiss Society of Radiology on May 5 and 6, 1951, in Lugano. Some of the most eminent investigators of these maladies participated in both symposia.

Obviously, the greatest difficulty in dealing with the reticuloses is the lack of a universally acceptable classification. This was stressed by Perussia,[1] who in his introductory remarks to the Swiss symposium rightly stated that the tumors of the reticulo-endothelial system structurally overlap the common endotheliomas, on the one side, and the blastomas of the lymphoid system, on the other. The problem is considerably complicated by the fact that elements of the reticulo-endothelial and hemopoietic systems have the same progenitors during the embryonal period and, in certain diseases, during later life. Furthermore, the existence of purely hyperplastic-reactive reticuloses often renders a differentiation between benign and malignant forms practically impossible.

In trying to create some order, Walthard,[2] in the same symposium, suggested a histopathologic classification based on the theory of the pluripotency of the primitive mesenchymal cell, illustrating how a single mother cell can give rise to enormously complex structures. His classification extends to all elements of the reticular system (connective tissue cells, reticulum cells, endothelial cells and blood cells) and includes the functional, regressive, heterotopic and inflammatory changes, as well as the generalized reticuloses and the malignant tumors of the reticular tissues. Among the reticuloses are placed the leukemic reactions, true leukemias and the various storage diseases, such as Gaucher's disease, Niemann-Pick disease and Schüller-Christian disease. The malignant tumors of the reticular tissues comprise Brill-Symmers disease, lymphosarcoma, reticulum cell sarcoma, transitional forms and sarcoma with highly differentiated intercellular substance.

The same trend was followed in the British symposium by Symmers,[3] who commented on the classification of Robb-Smith[4] which is most commonly used in that country. This classification is likewise based on the hypothesis of the pluripotency of certain primitive cells of the embryonic mesenchyme persisting throughout life. Under the general heading of reticulosis and reticulosarcoma, Robb-Smith

[1] Perussia, F. Introduction. *Radiol. clin.*, July, 1951, *20*, 220–224.

[2] Walthard, B. Pathologische Anatomie des Lymphogranuloms, Lymphosarkoms und Reticulosarkoms. *Radiol. clin.*, July, 1951, *20*, 224–254.

[3] Symmers, W. St. C. Some comments on the pathology of reticuloses. *Brit. J. Radiol.*, Sept., 1951, *24*, 469–475.

[4] Robb-Smith, A. H. T. Reticulosis and reticulosarcoma; histological classification. *J. Path. & Bact.*, 1938, *47*, 457–480.

placed a diversified group of lesions having the one common characteristic that the histopathologic changes are located either in the sinuses or the follicles or the medulla (reticular tissue of the cortex and medulla) of the lymph nodes or analogous tissues. Although such a topographical microscopic distinction has certain advantages, Symmers felt that the resulting classification is too complicated to be of practical use. Furthermore, it includes such conditions as simple sinus catarrh, reactive follicular hyperplasia, sarcoidosis and other lesions which differ greatly in pathogenesis and clinical significance. Symmers, therefore, proposes that the term of reticulosis be restricted to "a local or generalized proliferation of lymphoreticular tissue, occurring in the absence of any underlying infection, metabolic disturbance or other cause which can be demonstrated by methods at present available." He suggests the following simple clinicopathological classification: (1) benign reticulosis, of which the lympho-histiocytic medullary reticulosis of Robb-Smith's classification is the only one occurring rather frequently; (2) potentially malignant reticulosis, as for example, the follicular lymphoblastoma or Brill-Symmers disease, and (3) malignant reticulosis and the lymphoreticular sarcomas, comprising Hodgkin's disease and its related conditions, the Letterer-Siwe syndrome, the acute histiocytic medullary reticulosis described by Bodley Scott and Robb-Smith and the primary sarcomas of the lymphoreticular system.

This desire to simplify the classification of the reticuloses coincides with a tendency manifested for some time in the American literature where the aim was to segregate the extremely diversified disorders of the reticulo-endothelial system into groups of a more limited scope and better defined clinical and histopathologic characteristics. Thus, the proliferative processes originating from multiplication of one or more of the cell elements normally present in the lymph nodes or lymphoid tissue have long been considered as maladies of the lymphatic system and designated with the generic term of "malignant lymphomas." Gall and Mallory,[5] in 1941, proposed a division of this group into reticulum cell sarcoma (subdivided into stem cell lymphoma and clasmatocytic lymphoma), lymphoblastic lymphoma, lymphocytic lymphoma, Hodgkin's lymphoma, Hodgkin's sarcoma, and follicular lymphoma. Reactive processes to invading microorganisms of known properties, such as the tubercle bacillus, the spirochete, mycetes and even malarial parasites have been classified as granulomas and, if the stimulating agent was unknown, as granulomatous conditions. The storage diseases were designated as various types of thesaurismosis. A perusal of the more recent literature shows that the term of reticulosis or reticulo-endotheliosis has now been narrowed down to the designation of a few systemic diseases which are linked together by the predominating histiocytic cell element but in which the infectious agent cannot be demonstrated. These include Schüller-Christian disease, Letterer-Siwe disease and eosinophilic granuloma. Hodgson, Kennedy and Camp,[6] in commenting on the varying terminology, state that even in this group the name of systemic reticulo-endotheliosis is not entirely satisfactory. Freud,[7] after an exhaustive review of the problem, accepts the term with the same reservations and he includes reticulo-endotheliosis with leukemic response as the fourth type of the group. Less frequently the name of "lipoid" reticulo-endotheliosis is used for the designation of Gaucher's disease and Niemann-Pick disease, and the name of "lipomelanotic reticulosis" for the characterization of the chronic erythrodermia associated with enlargement of the superficial lymph nodes.

From the point of view of the radiol-

[5] Gall, E. A., and Mallory, T. B. Malignant lymphoma; clinico-pathologic survey of 618 cases. *Am. J. Path.*, 1942, *18*, 381–429.

[6] Hodgson, J. R., Kennedy, R. L. J., and Camp, J. D. Reticulo-endotheliosis (Hand-Schüller-Christian disease). *Radiology*, Nov., 1951, *57*, 642–652.

[7] Freud, Paul. Evolution of systemic reticuloendotheliosis in childhood. *J. Pediat.*, June, 1951, *38*, 744–769.

ogist, and for that matter of the clinician, the segregation of the reticuloses into more clearly defined groups and, whenever possible, into distinct clinical entities is an advantage. This was noted in the case of nearly all essayists of both symposia when the discussion extended to other phases than the pure histopathologic characterization. Thus Bodley Scott,[8] who closely follows the classification of Robb-Smith, in commenting upon some clinical aspects of the reticuloses draws a sharp line between Hodgkin's disease and "lymphoreticular medullary reticulosis," which is closely related to Hodgkin's paragranuloma of Jackson and Parker. In the former, he attributes only a palliative value to irradiation, whereas in the latter more than 50 per cent of the patients survive five years and 5 per cent are alive after fifteen years. Likewise, in "lymphoid follicular reticulosis" which corresponds to Brill-Symmers disease, the course is more benign than in "lymphoblastic reticulosarcoma," 50 per cent of the patients surviving five years and 10 per cent ten years or more.

Golding,[9] in discussing the roentgen findings in the reticuloses, states that these consist of various types of infiltration of the pulmonary parenchyma and of osseous lesions. In considering these latter, he calls attention to the ivory vertebra and Pott's disease resemblance of the spine in Hodgkin's disease, to the erosion of the medial side of the proximal metaphyses of the humeri in lymphatic leukemia of children, to the widespread homogeneous increase in density of long bones in myeloid leukemia and to the rather typical changes observed in lipoid reticulosis (Gaucher's disease) and in the triad of non-lipoid reticuloses (Letterer-Siwe disease, Schüller-Christian disease and eosinophilic granuloma). Obviously these more or less characteristic roentgen changes often constitute valuable criteria of a more exact differential diagnosis.

[8] Scott, Ronald Bodley. Some clinical aspects of the reticuloses. *Brit. J. Radiol.*, Sept., 1951, *24*, 475–478.

[9] Golding, F. Campbell. The radiological diagnosis of reticuloses. *Brit. J. Radiol.*, Sept., 1951, *24*, 478–485.

Perhaps mention should also be made here of the value of the "roentgen therapeutic test dose" in lymphomatous lesions not accessible for histologic study. This method[10] is based on the striking radiosensitivity of the lymphomas as compared to other types of malignant tumors and the degree of variation in the radiosensitivity which exists between proliferative processes of the lymphocytic cell element (lymphocytoma, lymphatic leukemia, aleukemic leukemia), on the one hand, and of the reticulo-endothelial cell element (Hodgkin's disease, reticulum cell sarcoma), on the other. By administering a standard dose of roentgen rays to such tumors and by observing their rate of regression, certain deductions can be drawn as to the nature of the cells, thus permitting a distinction between tumors of the same group.

The segregation of the various types of lesions included under the general heading of reticuloses is even more desirable when considering their treatment. Although irradiation, in the form of roentgen therapy, has been generally accepted as the best means of combating many of these lesions, the technique of procedure and the dosage differ so much from malady to malady that it is impossible to devise a common method. Some efforts have been made to give "spray" irradiation to the entire body or "bath" irradiation to segments of the body, but the former proved useful only in the leukemias and the latter, as demonstrated by Levitt,[11] had limited applicability in certain advanced forms of Hodgkin's disease. In most of the other groups a carefully individualized treatment is necessary depending not only on the type of the lesion but often also on its clinical stage and the degree of histopathologic differentiation. This fact is recognized in both symposia. Thus, Hilton[12] states that

[10] Reynolds, L., and Leucutia, T. The value of the roentgen therapeutic test dose in differential diagnosis of mediastinal tumors. Am. J. Roentgenol. & Rad. Therapy, 1942, *48*, 440–466.

[11] Levitt, W. M. Treatment of reticulosis by x rays. *Brit. J. Radiol.*, Sept., 1951, *24*, 485–490.

[12] Hilton, O. Some observations of the reticuloses and the treatment by x rays. *Brit. J. Radiol.*, Sept., 1951, *24*, 491–494.

"a breaking up of the reticuloses into groups is helpful as a rough guide to treatment and particularly to prognosis. Complicated classifications lead us nowhere." He divided the lymphadenopathies into six groups by closely following the classification of Gall and Mallory and established dosage levels and prognostic criteria for each of the groups separately.

In the Swiss symposium, Gilbert[13] likewise found it more convenient to assay the value of the irradiation separately for (1) Hodgkin's disease, (2) the lymphosarcomas which are subdivided into (a) Brill-Symmers disease, (b) true lymphosarcoma and (c) chronic lymphatic leukemia, and (3) the reticulum cell sarcoma. Based on long-range statistical study, he arrived at the conclusion that in order of decreasing frequency the greatest benefit is derived in Hodgkin's disease, localized lymphosarcoma and Brill-Symmers disease. Reticulum cell sarcoma, generalized lymphosarcoma, and chronic lymphatic leukemia have a more severe prognosis although exceptions may be found in each of them.

Very recently Childs and Kennedy[14] published the long-range results obtained by roentgen therapy in children afflicted with reticulo-endotheliosis comprising the triad of Letterer-Siwe disease, Schüller-Christian disease and eosinophilic granuloma. A similar non-uniformity in the prognosis and therapeutic response existed also within the members of this group.

All in all, it appears that despite the considerable progress made from the histopathologic standpoint, the reticuloses continue to remain clinically and radiologically a loose group of heterogeneous disorders. Segregation into more clearly defined categories and, whenever possible, into distinct clinical entities allows a more individualized therapeutic approach and is therefore desirable.

T. LEUCUTIA, M.D.

[13] Gilbert, R.-J. Lymphogranulome, lymphosarcome, réticulosarcome. *Radiol. clin.*, Sept., 1951, *20*, 313–336.

[14] Childs, D. S., Jr., and Kennedy, R. L. J. Reticulo-endotheliosis of children: treatment with roentgen rays. *Radiology*, Nov., 1951, *57*, 653–660.

SOCIETY PROCEEDINGS, CORRESPONDENCE AND NEWS ITEMS

MEETINGS OF ROENTGEN SOCIETIES*

United States of America

American Roentgen Ray Society
Secretary, Dr. Barton R. Young, Germantown Hospital, Philadelphia 44, Pa. Annual meeting: Shamrock Hotel, Houston, Texas, September 23, 24, 25 and 26, 1952.

American Radium Society
Secretary, Dr. J. E. Wirth, 635 Herkimer St., Pasadena 1, Calif. Annual meeting: Stevens Hotel, Chicago, Ill., June 8, 9 and 10, 1952.

Radiological Society of North America
Secretary, Dr. D. S. Childs, 713 E. Genesee St., Syracuse 2, N. Y.

American College of Radiology
Executive Secretary, William C. Stronach, 20 N. Wacker Drive, Chicago 6, Illinois. Annual meeting: Palmer House, Chicago, Ill., February 8, 1952.

Section on Radiology, American Medical Association
Secretary, Dr. T. Leucutia, Harper Hospital, Detroit 1, Mich.

Alabama Radiological Society
Secretary, Dr. J. A. Meadows, Jr., Medical Arts Bldg., Birmingham 5, Ala. Meets time and place Alabama State Medical Association.

Arizona Radiological Society
Secretary, Dr. R. Lee Foster, 507 Professional Building, Phoenix, Ariz. Two regular meetings a year. The annual meeting at time and place of State Medical Association and interim meeting six months later.

Arkansas Radiological Society
Secretary, Dr. Fred Hames, 511 National Bldg., Pine Bluff, Ark. Meets every three months and also at time and place of State Medical Association.

Atlanta Radiological Society
Secretary, Dr. J. D. King, 35 Linden Ave., N.E., Atlanta, Ga. Meets monthly, except during three summer months, on second Friday evening.

Brooklyn Roentgen Ray Society
Secretary, Dr. J. J. Daversa, 345 75th St., Brooklyn, N. Y. Meets monthly fourth Tuesday, October through April.

Buffalo Radiological Society
Secretary, Dr. Mario C. Gian, 610 Niagara St., Buffalo, N. Y. Meets second Monday evening each month, October to May inclusive.

Central New York Roentgen Ray Society
Secretary, Dr. Dwight V. Needham, 608 E. Genesee St., Syracuse N. Y. Meets January, May, November.

Central Ohio Radiological Society
Secretary, Dr. F. A. Riebel, 15 West Goodale St., Columbus, Ohio. Meets at 6:30 P.M. on second Thursday of October, December, February, April, and June at Columbus Athletic Club, Columbus, Ohio.

Chicago Roentgen Society
Secretary, Dr. B. D. Braun, 6 N. Michigan Ave., Chicago 2, Ill. Meets second Thursday of each month, October to April inclusive at the University Club.

Cleveland Radiological Society
Secretary, Dr. Mortimer Lubert, 10515 Carnegie Ave., Cleveland 6, Ohio. Meetings at 6:45 P.M. on fourth Monday of each month from October to April.

Colorado Radiological Society
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Connecticut Valley Radiologic Society
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Dallas-Fort Worth Roentgen Study Club
Secretary, Dr. X. R. Hyde, Medical Arts Bldg., Fort Worth, Texas. Meets in Dallas on odd months and in Fort Worth on even months, on third Monday, 7:30 P.M.

Detroit Roentgen Ray and Radium Society
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Louisiana Radiological Society
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* Secretaries of societies are requested to send timely information promptly to the Editor.

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PACIFIC ROENTGEN SOCIETY
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RADIOLOGICAL SECTION, BALTIMORE MEDICAL SOCIETY
Secretary, Dr. Richard B. Hanchett, 705-6 Medical Arts Bldg., Baltimore, Md. Meets third Tuesday each month, September to May.

RADIOLOGICAL SECTION, CONNECTICUT MEDICAL SOCIETY
Secretary, Dr. Fred. Zaff, 135 Whitney Ave., New Haven, Conn. Meets bimonthly on second Wednesday.

RADIOLOGICAL SECTION, MEDICAL SOCIETY OF THE DISTRICT OF COLUMBIA
Secretary, Dr. U. V. Wilcox, 915 Nineteenth St., N. W., Washington 6, D. C. Meets Medical Society Library, third Thursday of January, March, May and October at 8:00 P.M.

RADIOLOGICAL SECTION, SOUTHERN MEDICAL ASSOCIATION
Secretary, Dr. Roy G. Giles, Temple, Texas.

RADIOLOGICAL SOCIETY OF GREATER CINCINNATI
Secretary, Dr. Lee S. Rosenberg, Jewish Hospital, Cincinnati 29, Ohio. Meets first Monday each month, October through May.

RADIOLOGICAL SOCIETY OF KANSAS CITY
Secretary, Dr. Arthur B. Smith, 800 Argyle Bldg., Kansas City, Mo. Meets third Thursday of each month.

RADIOLOGICAL SOCIETY OF NEW JERSEY
Secretary, Dr. Nicholas G. Demy, 912 Prospect Avenue, Plainfield, N. J. Meets annually at Atlantic City at time of State Medical Society and mid-winter at Elizabeth, N. J.

RICHMOND COUNTY RADIOLOGICAL SOCIETY
Secretary, Dr. W. F. Hamilton, Jr., University Hospital, Augusta, Ga.

ROCHESTER ROENTGEN RAY SOCIETY, ROCHESTER, N. Y.
Secretary, Dr. George Gamsu, 191 S. Goodman St., Rochester, N. Y. Meets monthly on last Monday from September through May, 8:00 P.M. at Strong Memorial Hospital.

ROCKY MOUNTAIN RADIOLOGICAL SOCIETY
Secretary, Dr. Maurice D. Frazer, 1037 Stuart Bldg., Lincoln, Nebr.

ST. LOUIS SOCIETY OF RADIOLOGISTS
Secretary, Dr. D. S. Bottom, 510 S. Kingshighway, St. Louis, Mo. Meets fourth Wednesday each month, except June, July, August, and September.

SAN DIEGO ROENTGEN SOCIETY
Secretary, Dr. R. F. Niehaus, 1831 Fourth Ave., San Diego, Calif. Meets monthly, first Tuesday at dinner.

SAN FRANCISCO RADIOLOGICAL SOCIETY
Secretary, Dr. I. J. Miller, 2680 Ocean Avenue, San Francisco 27, Calif. Meets quarterly.

SECTION ON RADIOLOGY, CALIFORNIA MEDICAL ASSOCIATION
Secretary, Dr. D. R. MacColl, 2007 Wilshire Blvd., Los Angeles 5, Calif.

SECTION ON RADIOLOGY, ILLINOIS STATE MEDICAL SOCIETY
Secretary, Dr. Harold L. Shinall, St. Joseph's Hospital, Bloomington, Ill.

SHREVEPORT RADIOLOGICAL CLUB
Secretary, Dr. R. W. Cooper, Charity Hospital, Shreveport, La. Meets monthly on third Wednesday, at 7:30 P.M., September to May inclusive.

SOUTH BAY RADIOLOGICAL SOCIETY
Secretary, Dr. Ford Shepherd, 526 Soquel Avenue, Santa Cruz, Calif. Meets second Wednesday each month.

SOUTH CAROLINA X-RAY SOCIETY
Secretary, Dr. Henry E. Plenge, Spartanburg General Hospital, Spartanburg, S. C. One meeting with South Carolina Medical Association in May, others arranged by President.

TENNESSEE RADIOLOGICAL SOCIETY
Secretary, Dr. J. M. Frère, Newell Hospital, Chattanooga,

Tenn. Meets annually at the time and place of the Tennessee State Medical Association.

Texas Radiological Society
Secretary, Dr. R. P. O'Bannon, 650 Fifth Ave., Fort Worth 4, Texas. Meets Houston, Texas, January 18 and 19, 1952.

University of Michigan Department of Roentgenology Staff Meeting
Meets each Monday evening from September to June, at 7:00 p.m. at University Hospital.

University of Wisconsin Radiological Conference
Secretary, Dr. E. A. Pohle, 1300 University Ave., Madison, Wis. Meets first and third Thursdays 4:00 to 5:00 p.m., September to May inclusive. Room 203, Service Memorial Institute, 426 N. Charter St., Madison.

Utah State Radiological Society
Secretary, Dr. Angus K. Wilson, 343 S. Main St., Salt Lake City 1, Utah. Meets third Wednesday in September, November, January, March and May.

Virginia Radiological Society
Secretary, Dr. P. B. Parsons, Norfolk General Hospital, Norfolk, Va. Meets annually in October.

Washington State Radiological Society
Secretary, Dr. R. C. Kiltz, 705 Medical-Dental Bldg., Everett, Wash. Meets fourth Monday each month, October through May, College Club, Seattle.

Westchester Radiological Society
Secretary, Dr. Walter J. Brown, Northern Westchester Hospital, Mt. Kisco, N. Y. Meets on third Tuesdays of January and October and on two other dates to be announced.

Wisconsin Radiological Society
Secretary, Dr. Irving I. Cowan, 425 E. Wisconsin Ave., Milwaukee 2, Wis. Special meetings held during year; annual meeting each spring at Madison, Wis.

X-Ray Study Club of San Francisco
Secretary, Dr. M. A. Sisson, 450 Sutter St., San Francisco, 8, Calif. Meets January to July, Lane Hall, Stanford University Hospital; July to December, San Francisco Hospital.

Cuba, Mexico and Central America

Sociedad de Radiología y Fisioterapia de Cuba
President, Dr. J. Manuel Viamonte, Hospital Mercedes, Habana, Cuba. Meets monthly in Habana.

Sociedad Mexicana de Radiologia y Fisioterapia
General Secretary, Dr. D. P. Cossio, Marsella No. 11, Mexico, D. F. Meets first Monday of each month.

Sociedad Radiológica Panameña
Secretary, Dr. L. Arrieta Sanchez, Apartado No. 86, Panama, R. de P. Meets monthly in a department of radiology of a local hospital, chosen at preceding meeting.

British Empire

British Institute of Radiology Incorporated with the Röntgen Society
Ordinary meeting, on the Thursday preceding the third Friday, October to May at 8:15 p.m.
Medical Members' meeting, on third Friday in each month at 5:00 p.m., 32 Welbeck St., London, W 1.

Faculty of Radiologists
Honorary Secretary, Dr. J. F. Bromley, 45, Lincoln's Inn Fields, London, W.C.2, England.

Section of Radiology of the Royal Society of Medicine (Confined to Medical Members)
Meets third Friday each month at 4:45 p.m. at the Royal Society of Medicine, 1 Wimpole St., London.

Canadian Association of Radiologists
Honorary Secretary-Treasurer, Dr. Jean Bouchard, Suite 305, 1555 Summerhill Avenue, Montreal 26, Que. Meetings January and June.

Section of Radiology, Canadian Medical Association
Secretary, Dr. C. M. Jones, Inglis St., Ext. Halifax, N. S.

Société Canadienne-Française d'Electrologie et de Radiologie Médicales
Secretary, Dr. Origéne Dufresne, 4120 Ontario St., East, Montreal, P. Q.

Australian and New Zealand Association of Radiologists
Honorary Sectetary, Dr. Alan R. Colwell, 135 Macquarie St., Sydney, N.S.W.

Honorary Secretaries, State Branches:
New South Wales, Dr. E. W. Frecker, 135 Macquarie St., Sydney.
Victoria, Dr. T. L. Tyrer, 3 Lockerbie Court, East St. Kilda.
Queensland, Dr. J. Adam, 131 Wickham Terrace, Brisbane.
South Australia, Dr. R. deG. Burnard, 170 North Terrace, Adelaide.
Western Australia, Dr. A. M. Nelson, 179 B St. Georges Terrace, Perth.
New Zealand, Dr. E. G. Lynch, 12 Bolton St., Wellington.

South America

Asociacion Argentina de Radiologia
Secretary, Dr. Lidio G. Mocsa, Avda. Gral Paz 151, Córdoba, Argentina. Meetings held monthly.

Sociedad Argentina de Radiologia, Junta Central, Buenos Aires
Secretary, Dr. Oscar F. Noguera, Santa Fe 1171, Buenos Aires. Meetings are held monthly.

Sociedad Argentina de Radiologia, Filial del Litoral, Sede, Rosario
President, Dr. Francisco P. Cifarelli. Meets monthly second Wednesday, 19 ha 663 Italia St., Rosario, Santa Fe.

Sociedad Argentina de Radiologia, Filial del Sur, Sede, La Plata
President, Prof. Dr. Jose P. Uslenghi, La Plata. Meets monthly.

Sociedad Argentina de Radiologia, Filial del Centro, Sede, Cordoba
President, Prof. Dr. David L. Caro, Corro 86, Cordoba. Meets monthly.

Sociedad Argentina de Radiologia, Filial del Norte, Sede, Tucuman
President, Dr. Julio Mendez Valladares, Rivadavia 358, Tucuman. Meets monthly.

Sociedad Argentina de Radiologia, Filial de Cuyo Sede, Mendoza.
President, Dr. J. A. Orfila, Hospital Central, Mendoza. Meets monthly.

Sociedade Brasileira de Radiologia Medica
Secretary, Dr. Nicola Caminha, Av. Mem de Sa, Rio de Janeiro, Brazil. Meets monthly, except during January, February and March.

Sociedade Brasileira de Radioterapia
Secretary, Dr. Oscar Rocha von Pfuhl, Av. Brigadeiro Luiz Antonio, 644 São Paulo, Brazil. Meets monthly on second Wednesday at 9:00 p.m. in São Paulo at Av. Brigadeiro Luiz Antonio, 644.

Sociedad Colombiana de Radiologia
Secretary, Dr. Alberto Torres Focke, Av. 34, No. 17–34, Bogota, Colombia. Meets last Wednesday of each month.

Sociedad Peruana de Radiologia
Secretary, Dr. Julio Bedoya Paredes, Apartado 2306, Lima, Peru. Meets monthly except during January, February and March, at Asociación Médica Peruana "Daniel A. Carrión," Villalta, 218, Lima.

Sociedad de Radiologica, Cancerologia y Fisica Medica del Uruguay
Secretary, Dr. Arias Bellini, Av. Agraciada 1464, Piso 13, Montevideo, Uruguay.

Continental Europe

Société Belge de Radiologie
General Secretary, Dr. S. Masy, 111 Avenue des Allies, Louvain, Belgium. Meets monthly, second Sunday at Maison des Médecins, Brussels.

SOCIÉTÉ FRANÇAISE D'ELECTRO-RADIOLOGIE MÉDICALE, and its branches: SOCIÉTÉ DU SUD-OUEST, DU LITTORAL MÉDITERRANÉEN, DU CENTRE ET DU LYONNAIS, DE L'OUEST, DE L'EST, ET D'ALGER ET D'AFRIQUE DU NORD
Secretary-General, Dr. A. Dariaux, 9 bis, Boulevard Rochechouart, Paris IX^{e}, France.

CESKOSLOVENSK SPOLEČNOST PRO RËNTGENOLOGII A RADIOLOGII V PRAZE
Secretary, Dr. Roman Bláha, Praha XII, stát. nemocnice, Czechoslovakia. Meets monthly except during July, August, and September. Annual general meeting.

POLISH SOCIETY OF RADIOLOGY
Secretary, Dr. L. Zgliczynski, 59 Nowogrodzka St., Warsaw, Poland.

GDANSK SECTION, POLISH SOCIETY OF RADIOLOGY
Secretary, Dr. A. Smigielska, Akademia Lekarska, Gdansk. Meets monthly last Sunday at 10:30, X-Ray Dept., Akademia Gdansk.

WARSAW SECTION, POLISH SOCIETY OF RADIOLOGY
Secretary, Dr. L. Zgliczynski, 59 Nowogrodzka St., Warsaw, Poland. Meets monthly.

SOCIETATEA ROMANA DE RADIOLOGIE SI ELECTROLOGIE
Secretary, Dr. Oscar Meller, Str. Banual Mărăcine, 30, S. I., Bucuresti, Roumania. Meets second Monday in every month with the exception of July and August.

ALL-RUSSIAN ROENTGEN RAY ASSOCIATION, LENINGRAD
USSR in the State Institute of Roentgenology and Radiology, 6 Roentgen St.
Secretaries, Drs. S. A. Reinberg and S. G. Simonson. Meets annually.

SCANDINAVIAN ROENTGEN SOCIETIES
The Scandinavian roentgen societies have formed a joint association called the Northern Association for Medical Radiology, meeting every second year in the different countries belonging to the Association.

SOCIEDAD ESPANOLA DE RADIOLOGIA Y ELECTROLOGIA
Secretary, Dr. J. Martin-Crespo, Fuencarral, 7. Madrid, Spain. Meets monthly in Madrid.

SCHWEIZERISCHE RÖNTGEN-GESELLSCHAFT (SOCIÉTÉ SUISSE DE RADIOLOGIE)
Secretary, Dr. Max Hopf, Effingerstrasse 47, Bern, Switzerland.

DEUTSCHE ROENTGEN-GESELLSCHAFT
Honorary President, Prof. Dr. F. Haenisch, Wentzelstrasse 14 I, (24a) Hamburg 39, Germany. Meets annually in different towns.

SOCIETA ITALIANA DR RADIOLOGIA MEDICA
Secretary, Prof. Mario Ponzio, Ospedale Mauriziano. Torino, Italy. Meets biannually.

INDIA

INDIAN RADIOLOGICAL ASSOCIATION
Secretary, Dr. R. F. Sethna, Navsari Building, Hornby Road, Bombay 1, India.

CHANGE IN ROENTGEN-RAY PROTECTION HANDBOOK ANNOUNCED

Recent experimental work by the Radiation Laboratory of the National Bureau of Standards has shown that certain requirements governing the safe use of medical roentgen rays can be somewhat relaxed. Subcommittee 3 of the National Committee on Radiation Protection has therefore voted that the recommendation published in Section 7.1d of National Bureau of Standards Handbook 41, "Medical X-ray Protection up to Two Million Volts," now reading "The aluminum equivalent of the table top shall not be more than 0.5 millimeter at 80 kilov9lts when a Bucky is used under the table top," be changed to "The aluminum equivalent of the table top shall not be more than 1.0 mm. when measured at 80 kilovolts without a patient or phantom."

This change was announced by H. O. Wyckoff, chairman of Subcommittee 3 of the National Committee on Radiation Protection, which is under the sponsorship of the National Bureau of Standards in cooperation with the leading radiological organizations. NBS Handbook 41 is one of several roentgen-ray protection codes prepared by the Committee and published by the National Bureau of Standards.

RADIOLOGICAL SOCIETY OF NORTH AMERICA

At the Thirty-seventh Annual Meeting of the Radiological Society of North America held at the Palmer House, Chicago, Illinois, December 2–7, 1951, the following officers were elected for the coming year: *President-Elect*, Dr. Ira H. Lockwood, Kansas City, Missouri; *First Vice-President*, Dr. Harold G. Reineke, Cincinnati, Ohio; *Second Vice-President*, Dr. H. M. Berg, Bismarck, North Dakota; *Third Vice-President*, Dr. Donald R. Laing, Pasadena, California; *Secretary-Treasurer*, Dr. Donald S. Childs, Syracuse, New York (re-elected). Dr. Joseph C. Bell, Louisville, Kentucky, took office as the *President* of the Society.

RADIOLOGICAL AWARD GIVEN TO DR. G. E. PFAHLER

The Gold Medal of the Radiological Society of North America was presented to Dr. George E. Pfahler of Philadelphia at the annual banquet of the Society held on December 6, 1951, during the annual meeting in Chicago. The Medal, awarded for outstanding achievement in radiology, was presented by Dr. John S. Bouslog, Denver, retiring President of the Society, who called Dr. Pfahler the "dean of radiology" and a "pioneer in working for improvement in radiology."

GREATER MIAMI RADIOLOGICAL SOCIETY

At the December, 1951, meeting of the Greater Miami Radiological Society the following officers were elected: *President*, Dr. John Ajac, Mercy Hospital, Miami, Florida; *Secretary*, Dr. Maurice Greenfield, Ingraham Building, Miami, Florida. Meetings are held monthly, the third Wednesday of the month at the Veterans Administration Building.

WESTCHESTER RADIOLOGICAL SOCIETY

A new roentgen society, the Westchester Radiological Society, has recently been organized. The *Secretary* is Dr. Walter J. Brown, Northern Westchester Hospital, Mt. Kisco, New York. Meetings are held four times a year, on the third Tuesdays of January and October, and on two other dates to be announced.

SOCIEDAD RADIOLÓGICA PANAMEÑA

At a recent meeting of the Sociedad Radiológica Panameña the following officers were elected for the year 1952: *President*, Dr. E. Zubieta; *Vice-President*, Dr. R. Sandoval; *Treasurer*, Dr. M. Carrizo; *Secretary-Editor*, Dr. L. Arrieta Sanchez; *Deputy officers*, Dr. J. Flors and Dr. E. Burlando.

ANNOUNCEMENT

At its annual meeting held on December 6, 1951, the Los Angeles County Medical

Association elected Dr. Wilbur Bailey, radiologist of Los Angeles, President of the Society.

DIPLOMATES OF AMERICAN BOARD OF RADIOLOGY

To All Diplomates of the American Board of Radiology: There have been many changes of address among the diplomates in recent years and we find that we have not been notified of many of them. If any diplomate has changed address since certification and has not advised us, we would appreciate it if he would notify us of his present address. This will enhance our records and simplify the preparation of the next edition of the Directory of Medical Specialists. Notices should be sent to Dr. B. R. Kirklin, Mayo Clinic, Rochester, Minnesota.

Vol. 67, No. 2

ABSTRACTS OF RADIOLOGICAL LITERATURE

Department Editor: T. Leucutia, M.D., Harper Hospital, Detroit 1, Michigan

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ROENTGEN DIAGNOSIS

SKELETAL SYSTEM

GILLESPIE, JAMES B., and MUSSEY, ROBERT D. Progressive diaphyseal dysplasia (Engelmann's disease). *J. Pediat.*, Jan., 1951, *38*, 55–59.

Engelmann first described the entity which bears his name in 1929. Neuhauser and his co-workers presented the only pathological study of the disease in 1948. Eight cases have been reported.

The presenting symptoms are waddling gait, easy fatigability, failure to gain weight, and pain in the lower extremities. The intelligence of the patients is normal. Laboratory studies are uninformative. Roentgen studies show symmetrical involvement of all the long bones by a fusiform osteosclerotic enlargement of the diaphyses with normal epiphyses and metaphyses. The cortices are thickened and irregularly dense. The demarcation between normal and involved bone is sharply defined. When the skull is involved, it shows patchy thickening of the base, most marked in the anterior and middle fossae.

Bone biopsy shows, in the cortex, increased activity with eventual change to cancellous bone. The marrow is changed from a loose fatty type to a loose fibrous type with collections of mononuclear cells. Blood vessel walls show thickening.

The authors report an additional case in a thirty-three month old female.

The cause of the disease is unknown and the disease runs a self-limited course. Occasional neurological and nutritional changes indicate that more than the osseous system is involved in the syndrome. The differential diagnosis must include scurvy, Paget's disease, and polyostotic fibrous dysplasia. The author discusses the differentiation from infantile cortical hyperostosis, osteopetrosis and melorheostosis.—*R. M. Harvey, M.D.*

JOLLY, HUGH. Punctate epiphyseal dysplasia. *Proc. Roy. Soc. Med.*, March, 1951, *44*, 227.

This paper presents the case history of a ten-week old female delivered by caesarean section three weeks before term following failed version of a breech presentation. Birth weight was 5 lb. 10 oz. The child was well, but the right arm and leg were short. The skin was scaly, particularly on the right side.

Physical examination at ten weeks: Slight asymmetry of the skull. Right torticollis. Right arm and leg very short, due mainly to small length of humerus and femur, and held flexed with some stiffness. Right middle finger short. Skin appears normal. Equinus deformity of right foot. Eyes: Faint haziness of both corneae. Right lens shows peripheral striae of opacity, an unusual form of cataract. Left lens clear. Bilateral optic atrophy.

Investigations: Serum alkaline phosphatase 29 units. Blood inorganic phosphorus 6.0 mg. per cent. Serum calcium 11.2 mg. per cent.

Roentgenographic findings: Typical changes of punctate epiphyseal dysplasia in which the epiphysis appears to be ossifying from a number of separate centers producing a stippling effect. This is bilateral, but most marked in the right arm and leg, particularly in the humerus, femur, carpus and tarsus. The vertebral column and ribs are also involved.

Comment: Punctate epiphyseal dysplasia was first described by Fairbank in 1927 and named by him in 1935. Conradi had recorded a case in 1914.

The chief interest in this case is the short arm and leg which occurred only in 2 other recorded cases (Fairbank, 1949). Roentgenograms show the disease to be bilateral although more marked on the short-limbed side. In the 2 previously reported cases roentgenograms of the opposite side were not available.

This is the only reported case in which unilateral cataract occurred although bilateral cataracts are are not an infrequent association. Optic atrophy has also not been previously reported.—*D. R. Bernhardt, M.D.*

WAUGH, W. Polyarthritis with unusual bone changes. *Proc. Roy. Soc. Med.*, March, 1951, *44*, 247–249.

This paper presents the case history of a sixty-five year old male first seen in May, 1945, complaining of pain and swelling of the right knee. A diagnosis of senile tuberculous arthritis was made.

In July 1945, an excision and arthrodesis of the right knee was done. Biopsy material showed non-specific inflammatory changes in the synovial membrane, erosion of articular cartilage, widening of haversian canals and increase of fibrous tissue. No evidence of tuberculosis was found.

In November, 1945, there was solid bony ankylosis of the right knee.

Pain and swelling developed in the left ankle in January, 1946. Roentgenograms showed no abnormality. The clinical picture was that of subacute arthritis. The ankle was immobilized in plaster.

In May, 1946, the left ankle was much improved. Roentgenograms showed narrowing of the joint space and some sclerosis in the talus and navicular bone. Roentgenograms of the remainder of the skeleton showed no abnormality.

There was no pain in the left ankle in December, 1946, but there was pain and stiffness in both wrists and elbows. Roentgenograms of the left ankle showed erosion of cartilage and bone with dense sclerosis of the lower end of the tibia, talus, os calcis and navicular bone. Similar changes of less severity were beginning to appear in the wrists and elbows.

Present condition: Severe pain is present in both

wrists and elbows. There are no other symptoms and the patient's general health is good.

Examination shows limited movement and crepitus of both elbows. There is peri-articular thickening of both wrists with limitation of movement of right and full movement of left wrist. There is solid ankylosis of the right knee. Movements of the left ankle are good, but there is considerable peri-articular thickening. All other joints are normal. There are numerous small subcutaneous lumps on the arms which are presumably neurofibromas. No abnormality of the central nervous system is noted.

Roentgenographic findings: Both wrists, elbows and the left ankle show erosion of cartilage and destruction of bone which is not confined to articular surfaces. Neighboring bones show a very dense sclerosis. The remainder of the skeleton is normal apart from a dorsal scoliosis and some intervertebral lipping.

Investigations: In March, 1950, a mild hypochromic anemia responded well to iron therapy. Apart from anisocytosis and poikilocytosis no abnormal red cells were seen. The white blood cell count has always been within normal limits. The sedimentation rate at present (Wintrobe corrected) is 12 mm. in the first hour. During 1945 to 1948, it has varied from 29 to 59 mm. in the first hour (uncorrected). Wassermann and gonococcal complement-fixation tests were both negative (1947 and 1950). Serum phosphorus, calcium, alkaline and acid phosphatase have always been within normal limits.

Comment: The clinical picture is that of a chronic and, at present, inactive arthritis involving both elbows, wrists and left ankle. The feature of interest is the roentgen appearance. Gonococcal arthritis or secondary deposit from carcinoma of the prostate has been excluded as far as possible. There is no evidence to suggest any obscure form of industrial poisoning. It is unlikely that the dense sclerosis might represent a primary bone lesion since the history shows that a subacute arthritis without roentgen changes was the first stage and that erosion and sclerosis developed subsequently and progressed as the joint condition became less active clinically. This suggests that the basic lesion is an infective arthritis of unknown origin which is associated with unusual changes in neighboring bones.—*D. R. Bernhardt, M.D.*

Psenner, L., and Heckermann, F. Beitrag zur röntgenologischen Diagnose und Differentialdiagnose der fibrösen Dysplasie des Skelettsystems. (A contribution to the roentgenological diagnosis and differential diagnosis of fibrous dysplasia of the skeleton.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, March, 1951, *74*, 265–288.

Fibrous dysplasia may be a disease of the skeleton only (Lichtenstein) or it may be associated with pigment anomalies and sexual prematurity (Albright). At times solitary lesions are seen; usually there is polyostotic involvement.

The disease usually begins at an early age. It may come to a standstill when skeleton growth stops; in a few cases it slowly progresses throughout life. In a few cases it does not appear until adulthood.

Most frequently one-half of the body is involved to a greater extent than the other.

Roentgenological signs are widening of the diseased bone, thickening, elongation and deformity; the cortex is often thinned by a cystic lesion with trabecular destruction and trabecular changes.

The differential diagnosis is sometimes difficult, especially when there is an isolated lesion. Normally, however, with multiple bone involvement and with clinical history and findings the correct diagnosis is easily made.—*H. W. Hefke, M.D.*

Yettra, Maurice, and Starr, Paul. Polyostotic fibrous dysplasia associated with hyperthyroidism. *J. Clin. Endocrinol.*, March, 1951, *11*, 312–321.

This report deals with 2 cases showing the classical signs of polyostotic fibrous dysplasia with associated endocrinopathy and pigmentation of the skin which has been termed "Albright's syndrome." It also reviews the literature and presents 4 similar cases. The authors' cases showed changes in the bony skeleton including the skull and mandible together with pigmentation of the skin and basal metabolic rates above plus 40 per cent in each case. Biopsies of the diseased bone were obtained and showed the typical histopathologic picture. In the first case, radioactive iodine controlled the symptoms of hyperthyroidism. In the second case, the treatment for hyperthyroidism is not stated. The author feels that in 5 per cent of the cases of fibrous dysplasia hyperthyroidism is found and that this means that the relationship between these two conditions is more than coincidental. He has no explanation for this association, however.—*R. P. Barden, M.D.*

Höffken, W., and Heim, G. Melorheostose mit Sklerosierung der Knochen im rechten oberen Körperquadranten, Schädelbeteiligung und Hautveränderungen. (Melorheostosis with bone sclerosis in the right upper extremity, skull involvement and skin changes.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, March, 1951, *74*, 289–298.

This is a case history of a twenty year old man suffering from melorheostosis Léri of the right upper extremity for about three years. The authors describe fully the roentgenographic appearance and distribution of the lesions which also involved part of the skull and five ribs of the same side. The

patient died from a massive pulmonary embolus following a pericarditis and bilateral pleural effusion. The findings at autopsy (the first published to date) are described fully. The authors also had the opportunity of obtaining a biopsy a year prior to the patient's death. The histopathological findings of the biopsy and autopsy specimens are compared and it is interesting to note that, within one year, there were several distinct differences. For instance, whereas in the specimen taken at biopsy the bone was poor in calcium, after death it was extremely rich in calcium. The osteoblasts were arranged in several layers in the biopsy specimen; their number, one year later, was markedly diminished and they formed only one layer. The osteoclasts disappeared. It appeared that the sclerosing process of the bones, which was still active a year previously, had now been completed. This is believed to explain the contradictions in the literature in regard to the microscopic features of melorheostosis as described from study of the biopsy sections. Some authors noted the presence of osteoblasts and an early process of bone formation while others found complete eburnization without the presence of osteoblasts. It seems, on the basis of the findings of the case presented, that these are different stages of one and the same process.

In reviewing the literature, the authors found cases reported involving the upper and lower extremities, including one-half of the pelvis, of one side (Masserini) or both lower extremities (Burry, Klopfer, Haenisch), or even all four extremities (Müller-Alberti). However, the distribution was not completely without pattern inasmuch as no cross-arrangement was noted. In some cases reported, as well as in the authors' case, skin changes in the form of scleroderma were present in the corresponding limb. The authors point out the striking resemblance between melorheostosis Léri and osteofibrosis deformans juvenilis, and believe that the cause of both diseases may be an early embryonal disturbance at the same stage of bone development, although of different nature.

The authors conclude by stating that melorheostosis Léri is a bone disease of youth which is progressive during the growing years and becomes quiescent at the end of that period.—*S. Silvera, M.D.*

Boecker, W. Zum Krankheitsbild der Melorheostose (Léri); 2 kasuistische Beiträge. (The clinical picture of melorheostosis Léri; 2 case reports.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, March, 1951, *74*, 299–305.

Two case reports of melorheostosis Léri are presented. The first patient, a twenty-nine year old man, was observed for five years because of rheumatic pain in the left arm. The roentgenograms revealed evidence of melorheostosis involving several of the bones of the left upper extremity, particularly those of the fourth digit. The elbow could be extended only to 160° due to sclerotic changes in the humerus and ulna.

The second patient was a twenty-seven year old man who injured the medial meniscus of his right knee. The roentgenographic examination showed sclerosing changes of the medial condyle of the femur and the posterior aspect of the patella.

The author reviewed the literature and found that the youngest patient reported with melorheostosis was a five year old girl (Kibby) and the oldest, a fifty-nine year old man (Stutz). Several cases showed the presence of scleroderma in the involved extremity. In most of the cases only one extremity was affected, including shoulder girdle and pelvis. Burry and Klopfer reported cases with involvement of both lower extremities and Müller-Alberti, with involvement of all four extremities. Woytek described localization of the sclerosing process to one-half of the first to fourth lumbar vertebrae in a case which also showed changes in two ribs and the base of the skull.

Numerous causes have been proposed as etiologic factors of melorheostosis. These include parasitic illnesses, infectious diseases, toxic damage, trauma, endocrine disturbances, diseases of the sympathetic nervous system and vascular diseases. The author, however, believes that the most probable etiologic factor is a congenital developmental disturbance. He regards osteopoikilosis as related, having a similar etiology, and recommends that the two conditions be placed in a common group.

In conclusion, the author discusses the therapy of melorheostosis and suggests sympathetic block or sympathectomy in the hope that the progression of the disease may be averted, or slowed down.—*S. Silvera, M.D.*

Wright, Peter B. An unusual case of Paget's disease presenting an extraordinary degree of osteoblastic activity. *J. Bone & Joint Surg.*, Jan., 1951, *33-A*, 239–247.

The author reports a case of Paget's disease characterized by an unusual degree of osteoblastic activity. The patient was a Negro woman, aged twenty-six, who showed an enlargement of the cranial and facial bones with an extremely large and protruding mandible. The nares were flattened and the bridge of the nose had almost disappeared. The alveolar processes were greatly increased in size and the oral mucosa was stretched tightly over the bone. The lymphatic nodes were enlarged but not tender. There was a fixed thoracic kyphosis, lordosis in the lumbosacral area and a lumbar scoliosis. The thorax was barrel-shaped. The thoracic wall was pliable and there was marked angulation of the costochondral junction. The pelvic girdle was abnormal in shape and the extremities were small and atrophic.

Roentgenograms revealed a tremendous thickening of the bones of the skull and the face. The

vertebrae were collapsed and there was an irregularity of the cortices of the long bones with cystic changes. The appearance of a tibia and fibula, radius and ulna was typical of Paget's disease. At autopsy, the pattern of the cells in the sections of bone removed showed a structure resembling osteitis fibrosa.

Syphilis was ruled out in the case. Melorheostosis, thought by some to be a descriptive term and not a disease entity, is used to describe marked proliferation even of the facial bones and mandible. The author believes that the terms leontiasis ossea or melorheostosis can apply in his case of Paget's disease which possessed some concomitant findings which are so typical of von Recklinghausen's disease. He concludes that at least these two diseases were present in his case.—*R. S. Bromer, M.D.*

Wetzel, U., and Nordmann, F. Ostitis deformans Paget im Frühstadium. (The early stage of osteitis deformans Paget.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, March, 1951, *74*, 315–320.

The first roentgenographic changes in Paget's disease of the skull are often those of osteoporosis circumscripta cranii. A typical case is described. A biopsy confirmed the roentgen diagnosis. Roentgen therapy was tried but did not arrest the disease.—*H. W. Hefke, M.D.*

Baclesse, F., and Sarris, C. Métastases osseuses au cours des épithéliomas de la cavité buccale, du pharynx et du larynx. (Osseous metastases in carcinomas of the oral cavity, pharynx and larynx.) *J. de radiol. et d'électrol. & Arch. d'électric. méd.*, 1951, *32*, 10–15.

Osseous metastases secondary to carcinoma of the oral cavity, pharynx and larynx are extremely rare. In reviewing the literature, the authors found only 17 isolated cases recorded between 1886 and 1946. Anatomicopathologic statistics based on autopsy material which were published by investigators of the English language between 1934 and 1940, however, contradict this observation. The largest figure was given by Turner and Jaffe who, in 8 cases of carcinoma of the nasopharynx, noted an incidence of 37.5 per cent.

At the Fondation Curie in Paris 3,664 cases of carcinoma of the oral cavity, pharynx and larynx were treated from 1919 to 1945. Undoubted osseous metastases were demonstrated roentgenographically and by subsequent fatal termination in only 14 instances, or 0.38 per cent. The discrepancy as compared to anatomicopathologic statistics is attributed to two factors: (a) a certain number of metastases escape diagnosis by clinical and roentgenographic means, and (b) it is impossible to keep a systematic check on all the patients until their death.

The metastases appeared at various intervals. In 1 case they were noted during the course of treatment; in all others, they developed later, the longest interval being three years and ten months after the conclusion of the irradiation. Roentgenographically, they were all of the osteolytic type, a fact already mentioned by Turner and Jaffe.

Eight of the 14 patients were subjected to roentgen therapy with good palliative effect although recalcification was obtained in only one.—*T. Leucutia, M.D.*

Kleinberg, Samuel. Scoliosis with paraplegia. *J. Bone & Joint Surg.*, Jan., 1951, *33-A*, 225–230.

Paralysis of the lower extremities is an infrequent complication of scoliosis. Kleinberg reports a case which he states had unusual clinical features which made an early accurate diagnosis difficult. It emphasized the importance of early laminectomy and the variety of technical detail which may be required for adequate decompression of the cord. The patient was a girl, twelve years old, who had been admitted to a hospital in Puerto Rico at the age of ten years with a diagnosis of Pott's disease, with paralysis of the lower limbs. Roentgenograms showed on her admission to the hospital an "angular kyphoscoliosis" at the dorsolumbar level. The basis of the scoliosis was apparently a supernumerary hemivertebra on the right side between the tenth and eleventh dorsal vertebrae. It was finally concluded that the patient had paraplegia due to an osseous deformity of the spine, a congenital scoliosis with kyphosis with compression of the spinal cord. In the differential diagnosis, the following conditions were reviewed: tuberculosis, von Recklinghausen's disease, injury, congenital scoliosis.

Decompression laminectomy was performed. There appeared to be, at operation, a definite constriction of the cord in the region of the twelfth thoracic and first lumbar as a result of the deformity of the spine. When this constriction was removed, an easy passage of a probe distal to the area of laminectomy was observed. The dura was not opened. The laminectomy resulted in only partial improvement. In an effort to produce further improvement, and enable the patient to stand, and walk, a posterior bone block and subtalar and calcaneocuboid arthrodeses were performed on the right foot. After a few months, a stabilization operation was performed on the left foot. After these operations the patient was able to stand with the aid of crutches.

The author discusses the following causes of compression of the cord complicating scoliosis: unequal growth of dura and spinal column, sudden increase in scoliosis, anomalous tight dural band, spur of bone in the neural canal, angulation of the cord, tightness of nerve roots and injury.—*R. S. Bromer, M.D.*

Klopfer, F. Die Protrusio acetabuli (Otto-Chrobak'sches Becken). (Protrusion of the acetabulum: Otto-Chrobak's pelvis.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, March, 1951, *74*, 323–328.

The author reports 3 cases of protrusion of the acetabulum, due to two different etiological factors: (a) constitutional developmental disturbance of the socket floor, and (b) acquired weakness, *i.e.*, a localized inflammatory process.

In the first, or idiopathic, type the involvement is bilateral and quite symmetrical. The condition occurs mostly in females and may be hereditary. It appears at puberty with no previous history of trauma or local disease. The one case presented is that of a female, aged thirty-five, who started to have backache at the age of seventeen. The roentgen examination showed the typical criteria of Otto's pelvis. The author draws attention to the arrangement and course of the stress lines in relation to the architecture of the bone trabeculae in the neck and head of the femur. Normally, the main stress lines are equally developed in the medial and lateral halves of the femur. In Otto's pelvis, they are more pronounced on the lateral side because of the associated coxa vara deformity. According to Hayds, these changed mechanics may be responsible for the disease.

In the second, or acquired, type, there is usually a unilateral secondary disturbance of the acetabular floor, without evidence of a hereditary or constitutional factor. The author presents 2 cases. In 1 case, that of a woman, aged fifty, the head of the contralateral femur, following epiphyseal separation from an injury at the age of fourteen, has been completely absorbed and the neck articulated with a pseudojoint at a higher level. In the other, that of a woman, aged forty-two, an inflammatory process of the right hip joint of long standing produced secondary destruction and bulging of the floor of the acetabulum.

The author concludes by discussing the question as to whether protrusion of the acetabulum is related to congenital dislocation of the femoral head. The opinion is expressed that in protrusion of the acetabulum the socket floor is too thin, allowing bulging into the pelvis, while in congenital dislocation it is too thick, not leaving enough room for the head of the femur and thus encouraging a dislocation. This hypothesis was advanced by Schaap and Brentrup and endorsed again recently by Hayds, who believes that both conditions may occur in the same family as related developmental anomalies. The author, however, doubts this relationship inasmuch as no proof exists that protrusion of the acetabulum has been observed in the newborn or small children.—*S. Silvera, M.D.*

Blood and Lymph System

de Backer, Jean, and Lawrence, John H. L'association de la leucémie à la polycythémie vraie. (The association of leukemia and polycythemia vera.) *Presse méd.*, April 7, 1951, *59*, 461–463.

The pertinent literature is briefly reviewed. Out of 150 patients treated at the Donner Laboratory, University of California, Berkeley, the authors present in detail 6 polycythemia vera cases, 1 myeloid leukemia and 1 lymphatic leukemia case, pointing out the close relationship of polycythemia vera to leukemia and vice versa. They also note that after P^{32} treatment of polycythemia vera the leukemic complication is less frequent; hence the advantage of this treatment.

Chronic leukemia and leukemoid reactions are frequent complications of polycythemia vera, while acute leukemia is rarely so. On the other hand, a typical myeloid or lymphatic leukemia may take the characteristics of polycythemia vera with leukemoid or leukemic reaction. These observations lead the authors to suggest that there exists a fundamental relationship between polycythemia vera and leukemia and that the former is a disease of not only the erythropoietic system but of the whole bone marrow. Thus there is hyperformation of erythrocytes, of leukocytes and of platelets in polycythemia vera.—*J. N. Sarian, M.D.*

Bonte, G., and Desruelles, J. La thrombose du carrefour aortique terminal. Étude clinique et aortographique (intérêt des clichés multiples). (Thrombosis of the terminal aortic bifurcation; clinical and aortographic study; value of multiple films.) *J. de radiol. et d'électrol. & Arch. d'électric. méd.*, 1951, *32*, 15–20.

Whereas the indications for arteriography of the extremities are now fairly precise, those for aortography are still rather indefinite. This is due to the vague symptoms which often characterize the clinical picture of thrombosis of the bifurcation of the aorta.

The authors give a detailed description of the symptoms, signs and clinical course of aortic thrombosis, since they are convinced that this condition occurs more frequently than is generally realized. Aortography is of great aid not only in establishing the diagnosis but also in evaluating the extent of the involvement. It would be useless to resect the thrombosed lower segment of the aorta if, for example, a second lesion is present higher up.

The authors state that the technique of aortography for demonstration of aortic thrombosis is well known and widely employed. They themselves have made routine use of the method since 1946 without observing any untoward effects. They would like to emphasize the following practical points:

(1) *Site of puncture.* The selected site of puncture is at the level of the third and fourth lumbar vertebrae. At this level the aorta has already given off its abdominal visceral branches (celiac trunk, superior mesenteric artery, renal artery, inferior mesenteric artery), and therefore a stronger opacification

of the bifurcation and iliac vessels is obtained. At the same time, the danger of entering the renal artery is avoided. In case the thrombosis extends above the selected level, a second or third puncture is attempted higher up, being always mindful of the fact that the needle might have been introduced into a visceral artery. A good differentiating maneuver is to displace the needle, once it has entered the blood vessel, at least 1 cm. upward. This would be impossible in a small caliber artery. As an added precaution the authors prefer to do the injection of the opaque medium manually with the aid of a syringe. The resistance encountered during the injection is fairly indicative of the type of vessel which has been entered. They have several times inadvertently injected the right renal artery without serious consequence due to the fact that the injection was made under controlled pressure.

(2) *Pressure.* The control of the pressure is also important when the injection is made into the aorta and there is a complete obliteration of both iliac arteries by the thrombosis. The apparatus of Dos Santos does not permit a pressure-controlled injection so that until the idea of an automatic registration of the pressure during the entire injection, as proposed by Reboul, is realized, the authors prefer to use a syringe. The injecting hand is protected from the roentgen exposure by attaching the syringe to the needle by means of a long rubber tube.

(3) *Multiple films.* The authors constructed a special roentgenographic table which permits the taking of three aortograms at intervals of two seconds, beginning immediately after the injection of 20 cc. of opaque substance. The serial aortograms are indispensable for evaluation of the collateral circulation in case of complete obstruction by the aortic thrombosis.—*T. Leucutia, M.D.*

Lockhart-Mummery, H. E., and Smitham, J. Hillyer. Varicose ulcer; a study of the deep veins with special reference to retrograde venography. *Brit. J. Surg.*, Jan., 1951, *38*, 284–295.

The writers begin their article by wishing to dispel the widely held misconception that varicose ulcer is the result of long-standing varicose veins.

They believe patients with varicose veins can be divided into three different clinical categories: (1) those with varicose veins whose skin in the lower leg is perfectly healthy; (2) those with pigmentation, induration and even ulceration of the leg; (3) those with both ulceration and varicose veins in the thigh and leg.

The writers give a detailed clinical description of the above three groups of cases, and their response to treatment is discussed. No attempt is made to impose a rigorous classification. The authors believe a clear distinction between groups 1 and 2 is essential to a realization that visible varicose veins are not the sole cause of these ulcers, if indeed they are a cause at all.

Throughout the article it is stressed that there is definite evidence that there is one factor, namely, previous thrombosis, which is known to be a cause of lower leg induration and ulcer. The writers decided, therefore, to study deep veins in cases of varicose ulcer by venography in order to determine to what extent abnormal appearances in those veins were associated with varicose ulceration.

According to the writers, venography by the standard technique (with the patient lying supine) does not approach the root of the problem of varicose ulcers, which are thought to be due to man's erect posture and the consequent factor of gravity. *They therefore decided to obtain venograms with the patient as near as possible in the erect position, and injecting the radiopaque material into the femoral vein in the groin.* (In actual practice both ascending supine venograms and descending venograms in the erect posture are done.) The roentgen technique of descending venograms is given in detail, and excellent normal and abnormal venogram illustrations are presented. Difficulties, complications and dangers of their roentgen technique are pointed out.

On the basis of careful and detailed study of 30 patients, the writers believe that the following conclusions are justified:

(1) That after thrombosis of the deep veins of the leg recanalization (with destruction of valves) does occur in the majority of patients. The rate at which it does so varies, but it is certainly a slow process probably occupying at least twenty years and sometimes longer before it is complete. This is in agreement with the observations of Linton and Hardy who, in a series of 84 posthrombotic cases explored surgically, found evidence of recanalization of the femoral vein in all cases. It can be said with certainty, however, that venography by the ordinary methods is inaccurate and misleading on this point. It seems likely that the recanalization proceeds from above downwards, probably by the formation of small channels that later enlarge and coalesce, and that not until a channel has formed throughout the whole length of the thrombosed vein can that channel be seen by ordinary venographic methods.

(2) That the occurrence of previous thrombosis cannot be excluded either by the patient's history or by a venogram by the ordinary technique.

(3) That, on the whole, the development of intractable ulceration and serious symptoms after thrombosis is delayed until recanalization is far advanced. It is certain that the circulation in the limb must be seriously disturbed by such recanalization, as there is then an unbroken column of blood unsupported by valves from the right auricle to the lower leg when the patient is in the erect position. The venous pressure in such a leg would thus be abnormally high and stasis severe, and this would

account for the frequent development of bursting pain, edema, induration, and ulceration.

(4) That in other cases showing induration and ulceration where previous thrombosis has not occurred, similar femoral vein insufficiency with backpressure can be demonstrated and is probably the causative factor.

(5) That in patients with varicose veins in whom the skin of the lower leg is healthy, the femoral vein is normal or nearly so.

It seems likely that saphenous incompetence with obvious varicose veins may occur with or without associated deep vein incompetence. It is the latter factor which determines the venous stasis in the lower leg and predisposes to ulceration, and the high pressure in the deep veins may well be the factor causing the recurrence of varicosities not infrequently seen after adequate saphenous ligation.

Finally, the writers state that "many facets of the problem of ulceration and its causes remain to be examined, and the factors of vasospasm, collateral circulation, saphenous incompetence and femoral incompetence all need further study before the full answer can be known."—*R. F. Niehaus, M.D.*

JANES, JOSEPH M., and IVINS, JOHN C. A method of dealing with arteriosclerotic popliteal aneurysms. *Surgery*, March, 1951, *29*, 398–406.

The authors report their experience in the treatment of arteriosclerotic popliteal aneurysms by means of lumbar synpathectomy followed immediately or at a later time by extirpation of the aneursym. Treatment is urged so that rupture of the aneurysm or embolic phenomena may not occur. The technique is a modification of that of Linton published in 1949.

The clinical signs of these aneurysms are (1) globular pulsating swelling, (2) distinct thrill and systolic murmur, (3) congestion and edema of the parts beyond, (4) pain and disturbances of sensation and (5) erosion phenomena. All of these may not occur in any one instance. After a careful history is taken, the physical examination is done. The vascular status of both lower extremities is evaluated. Routine roentgenograms of the knee often show the presence of this lesion but an arteriogram gives more accurate information as to the size and position of the aneurysm and the extent of the collateral circulation. It also aids in the differential diagnosis. By means of two portable roentgen-ray machines roentgenograms in the anteroposterior and lateral views are made almost simultaneously after the injection into the femoral artery of 50 cc. of 35 per cent solution of diodrast. The patient is previously tested by means of an intradermal injection of this medium to exclude possible untoward reactions. The femoral artery is exposed for the injection by a longitudinal incision and the vessel is isolated with a tape. This incision is closed after the injection as soon as bleeding has ceased. Several days after this procedure lumbar sympathectomy is performed. The first, second and third lumbar ganglia and the sympathetic trunk are removed by the extraperitoneal route. The popliteal aneurysm is removed through an adequate longitudinal incision over the line of the artery. The method of extirpation of the aneurysm is described in detail.

After the operation a modified Robert Jones protective dressing is applied from the base of the toes to the groin so that the extremity may be immobilized without damage to the soft tissues. General supportive measures include the intravenous use of 5 per cent alcohol in dextrose until 2 fluid ounces of whiskey by mouth can be tolerated every four hours. Papaverine is administered every four hours in ½ grain doses. A heat cradle is placed over the trunk and care is taken not to elevate the limb. Anticoagulant drugs are considered to be neither necessary nor advisable.

Of the total group of 42 patients 41 were males. In half of these cases the aneurysms were unilateral. In 1 case there were additional bilateral femoral aneurysms; another patient had aneurysms of the left dorsalis pedis artery, and in 1 remarkable case there were aneurysms of both iliac and femoral arteries in addition to the popliteal aneurysms.

Twenty patients of this group were treated conservatively. In 7 cases amputation was performed. Fourteen patients, presenting 15 aneurysms, were treated by operation with or without sympathectomy. Sympathectomy with subsequent aneurysmorrhaphy gave a good result in 3 cases. An excellent result was obtained by aneurysmorrhaphy alone in 1 instance. A similar result was obtained for 1 patient who had only extirpation of the aneurysm.

This report primarily concerns 8 patients with 9 arteriosclerotic popliteal aneurysms who were treated by lumbar sympathectomy followed by delayed or immediate extirpation of the aneurysm. No deaths occurred in this group and the results were considered good in each case.—*C. B. Holman, M.D.*

LUKE, JOSEPHUS C. The deep vein valves; a venographic study in normal and postphlebitic states. *Surgery*, March, 1951, *29*, 381–386.

The author reports data from 52 patients who underwent retrograde venography in order that the status of the deep veins might be established after previous thrombophlebitis of the deep veins. He also carried out similar studies on 3 patients who were considered to have normal deep veins.

Two techniques were employed, the first consisting of direct venipuncture of the common femoral vein with injection of 20 cc. of diodrast. The femoral

vessels were compressed against the pubic ramus, closing the vein centrally. Because abnormal venous pressures may result from this method of injection the following second technique was adopted. A small catheter coudé was introduced through the stump of the saphenous vein during the course of a high saphenous ligation and its tip was directed into the common femoral vein. Diodrast was then injected through the catheter and three roentgenograms were made. The patient held a deep breath and strained before each exposure. Retrograde venography showed the common and superficial femoral veins of 2 of the 3 normal patients to be without valves. This is regarded as a congenital absence of the valves of these veins. Although all these patients had slight, chronic enlargement of the lower extremity with increased cyanosis and dilated cutaneous venules, evidence of cutaneous malnutrition was not present. The author concludes, therefore, that the changes in the postphlebitic leg are not always the result of venous incompetence and increased venous pressures. Nine patients who were not expected to have abnormalities of the deep veins were found to have varying degrees of retrograde filling when the catheter technique was employed. The medium passed through some normal valve stations and was stopped by others. The author infers, therefore, that valvular efficiency varies to some extent in the normal deep venous system.

Cases of 32 patients who had histories of definite thrombophlebitis of the deep veins were studied. Venipuncture had failed in 10 cases and 4 of the 10 patients underwent exploration of the common femoral vein. In each instance the vein was represented by a firm white cord. Microscopic examination revealed an organized thrombus with small areas of recanalization. There was, therefore, "almost a complete pathologic vein ligation," but the postphlebitic complications were just as pronounced as they were for other patients whose veins were still patent.

In 1 instance the catheter was inadvertently inserted through the saphenofemoral junction into a large accessory saphenous vein. The roentgenogram showed retrograde filling of the veins of the opposite thigh. This lower extremity had not been involved previously by phlebitis and was symptomless. This provided another instance of retrograde filling in a supposedly normal venous system. The author concludes that significant variations exist in the valves of the deep veins and although the saphenous valves may be weak or absent these conditions do not necessarily lead to pathologic changes in the involved lower extremity. He also suggests that the damage produced by phlebitis of the deep veins has little bearing on the extent, degree and type of most postphlebitic complications, because these changes may occur in the presence of almost complete occlusion of the vein. He concludes that there is little rationale in the treatment of these patients by ligation of the deep femoral vein. Correction of the associated incompetent secondary varicose veins, lumbar sympathectomy and skin grafting are suggested as methods of treatment.

Complications are said to be extremely rare if the patient follows the suggestions presented by the author under the title "The New Way of Life." He recommends continued use of the elastic stocking and elevation of the affected extremity for fifteen minutes after every thirty minutes during which the patient had been standing. The affected extremity should be raised whenever possible. A bland cold cream should be applied to the affected skin about every second night, and the patient is cautioned to avoid any possible irritation of the extremity.—*C. B. Holman, M.D.*

General

Gladstone, Sidney A. Sponge biopsy in office practice: a new method in the diagnosis of cancer. *J.A.M.A.*, April 21, 1951, *145*, 1238–1244.

In this article Gladstone presents a method for biopsy of accessible malignant lesions which is easy to apply in the office by a relatively unskilled person. The procedure consists of firmly rubbing a gelatine or cellulose sponge on the surface of the lesion and transferring the sponge with the adhering tissue fragments to a fixative. Mounting, sectioning and staining of the sponge and occluded material are done by the techniques used routinely in the pathological laboratory for the handling of tissue specimens. In contradistinction to exfoliative techniques such as that used by Papanicolaou, the cells obtained by sponge biopsy present an appearance and arrangement which is familiar to the average pathologist, and therefore no new cytological criteria need be learned. A full description of the technical procedures in the method is given, which would seem to be sufficient to permit the institution of the method in any office.

In the article there is a discussion of the application of the method to the diagnosis of carcinoma of the cervix, rectum, mouth and skin. From the results presented a satisfactory degree of accuracy appears to be demonstrated, although there is little discussion of the false negative results.—*R. J. Bloor, M.D.*

Ewing, M. R., and Powell, T. Some observations on the diagnosis of clinically pigmented skin tumours. *Brit. J. Surg.*, April, 1951, *38*, 442–454.

Pigmented sclerosing angioma is a relatively benign lesion but clinically and grossly may simulate malignant melanoma so closely that all efforts should be made to differentiate the two conditions as the

ultimate prognosis and treatment are so vastly different.

The authors (after having had the unfortunate experience of making this error of diagnosis in 1 case) present 11 examples of sclerosing angioma. They also list 26 cases of pigmented papilloma, 25 of which had been misdiagnosed as nevus, mole or malignant melanoma. Great stress is placed on determining the nature of the pigment present, whether it is blood pigment hemosiderin, or melanin, the former always being present in pigmented sclerosing angioma. However, one is not to be led astray by this test, because unless all of the pigment is hemosiderin, an ulcerating melanoma cannot be excluded. A reticulin stain to show the angiomatous pattern of the sclerosing angioma with the positive hemosiderin test is the surest means of establishing the proper diagnosis.

A statistical analysis is given of sclerosing angioma as to age, sex, number of lesions, site, pre-existing lesions, symptoms and clinical signs.

The authors state that there is no certain way of distinguishing clinically between the two entities when the lesion is single. They feel that biopsy is indicated in all cases with a wide removal of skin and fascia keeping at least 4 to 6 cm. from the margin of the tumor on all sides. This they believe will not alter the prognosis or disseminate the disease if it is malignant, and if the lesion is benign a disfiguring surgical procedure is avoided. In the malignant disease their choice of treatment is wide excision with radical lymph node dissection. Mention is made of 1 case which was treated by roentgen therapy (2,000 r) that cleared completely but the clinical diagnosis had been rodent ulcer.

In discussing the pathology, the authors review the early theories and opinions and conclude that sclerosing angioma originates in one of the common, simple, hemangiomas which for some reason has undergone fibrosis. The gross appearance of the two tumors may be so much alike that one cannot differentiate them.

A histopathological analysis is made of 123 pigmented tumors examined in the authors' Department of Pathology. These are placed in three main groups according to the type of pigment present and its situation in the skin. In the first two groups, the pigment is melanin which in one is confined to the epidermis alone while in the other, the true melanoma, it is diffusely scattered in the adjoining dermis. In the third group the pigment is hemosiderin.

There are excellent photographs and microscopic sections demonstrating the two conditions.—*L. L. Lemak, M.D.*

WILLIAMS, J. ALED. Congenital hemihypertrophy with lymphangioma. *Arch. Dis. Childhood*, April, 1951, *26*, 158–161.

Congenital hemihypertrophy is a condition in which the whole of one side of the body is increased in size from birth. More than 100 such cases have been described in the literature since the first report was made in 1839. In most cases gross asymmetry has been obvious and subcutaneous tissue appeared to be thickened. More than half of the cases showed other abnormalities in addition to the hypertrophy.

A case of hemihypertrophy is described which involved only the lymphatic elements. The right ulna, some of the bones of the wrist and the metacarpals also appeared slightly enlarged.

Some notes are made on the theories as to etiology.—*P. R. Dirkse, M.D.*

STRANG, CHRISTOPHER. The Looser-Milkman syndrome; occurrence in a case of idiopathic steatorrhoea. *Brit. J. Surg.*, April, 1951, *38*, 489–498.

A forty-six year old female patient is described who had a complete fracture of the neck of the left femur and pseudofractures in the ribs, in the subtrochanteric region of the right femur and in the lower end of the left femur.

In a search for the underlying cause the patient was found to have idiopathic steatorrhea. This was not causing any alimentary disturbance but there was a profound hypochromic anemia associated with histamine-fast achlorhydria.

The patient was treated with vitamin D (100,000 units daily), calcium and iron for three months, this resulting in a dramatic clinical cure with complete healing of the fractures. She has since been observed for three years without developing any further symptoms.—*J. J. McCort, M.D.*

JACKSON, W. P. U. Osteo-dental dysplasia (cleido-cranial dysostosis); the "Arnold head." *Acta med. Scandinav.*, 1951, *139*, 292–303.

A Chinese who settled in Cape Malay had 356 descendants, of whom 70 have been affected with osteodental dysplasia.

This condition affects far more than just bones developing from membrane. The permanent teeth, facial bones, sternum, scapulae, vertebrae, pelvic bones, long bones, metacarpals and phalanges may also show defects (both ectodermal and mesodermal structures). The unknown causal agent is operative from the fifth week of fetal life for an indefinite period, possibly extending into childhood. The name "cleidocranial dysostosis" is inadequate; the term "osteodental dysplasia" is more appropriate and more comparable with the related disorder, achondroplasia.

More females were affected than males; no evidence of sex-linkage was noted. There was no evidence to suggest incomplete penetrance of the trait, which might lead to undiagnosed cases.

All affected members of the family over twenty years of age had lost all of their teeth. Other true disabilities were postural deformities of the spine,

coxa vara, genu valgum, talipes, pes planus, occasional congenital dislocations, and deformities of the pelvic inlet which may even indicate cesarean section.—*Charles Nice, M.D.*

Scott, Roland B., and Banks, L. Otto. Cleidocranial dysostosis syndrome; report of a case in a negro child exhibiting retarded growth. *Am. J. Dis. Child.*, March, 1951, *81*, 394–402.

A case of cleidocranial dysostosis in a four year old Negro girl is reported. In addition to the typical cleidocranial defects, the child exhibited retarded physical, dental and epiphyseal growth as well as the absence of the pubic bones. Roentgenograms of the child at the age of four days showed only a shell of the frontal and occipital bones of the skull. Both parietal bones were entirely membranous in type and could not be visualized in the roentgenogram. The films of the lower extremities at the same age showed complete absence of the tibial and femoral epiphyseal centers at the knee, also the calcaneus, astragalus and cuboid of the ankle. At four and one-half years of age, the cranium was large with a wide transverse diameter and wormian bones. The pelvis at the same age showed wide separation of the ilia and absence of the pubic bones. The usual absence of the clavicles was shown.

The authors attribute the defective skeletal and physical development to a widespread deficiency in the germ plasm which they believe is part of the cleidocranial dysostosis syndrome.—*R. S. Bromer, M.D.*

Albeaux-Fernet, M., Deribreux, J., Tchékoff, S., and Bréant, P. Le syndrome de Turner (à propos de 5 observations personnelles). (Turner's syndrome, with reference to 5 cases observed personally.) *Presse méd.*, March 7, 1951, *59*, 285–290.

The authors present a detailed study of 5 cases of Turner's syndrome observed within three years of their hospital practice. Short stature and hypogonadism comprise the main clinical features of this syndrome of congenital nature. Diffuse osteoporosis (particularly of the dorsal vertebrae and of the pelvis) and chondrodystrophy of the spine are constant roentgenographic findings. Digital markings of skull are often noted. In 1 case where death occurred after appendectomy, the autopsy showed a congenital subluxation of atlanto-odontoid articulation, infantile genital organs, normal brain and pituitary, tendency of ovaries to cystic degeneration.

In the female there is often an increase in the folliculin stimulating hormone of pituitary and a decrease of 17-ketosteroids and amenorrhea. In the male, azoosperima is often noted. The authors point out that the folloculin stimulating hormone increase is not constant and hence a celioscopic survey of the pelvic organs is of more diagnostic value.—*J. N. Sarian, M.D.*

Mason, Michael L. Irradiation injuries of the hand. *Quart. Bull., Northwestern Univ. M. School*, Spring, 1951, *25*, 51–59.

The author states that the increasingly high incidence of irradiation dermatitis presents a very difficult therapeutic problem and that those who are exposed to irradiation must be fully informed as to the need for taking the necessary precautions and of the consequences of carelessness. Indications for radiation therapy and the indiscriminate use of this agent must be severely censored.

Irradiation injuries are plaguing, irritating and often treacherous as they may not develop for months or even years after exposure.

The hands, the soles of the feet, and the perineal and peri-anal regions are particularly liable to irradiation damage. Figures quoted show a high percentage of irradiation damage to physicians' hands.

The author divides the cases of irradiation damage into five groups: (1) those individuals whose exposure to irradiation consisted of many small or minute doses extending over a period of months or years representing occupational or vocational hazards of irradiation. (2) Those receiving a massive overexposure which occasionally is accidental. Many acute over-exposures are due to prolonged fluoroscopy in search for a foreign body wherein time passes rapidly and is not noticed; others result from overexposure during diagnostic fluoroscopy and cases are quoted where commercial use of the fluoroscope has caused damage. (3) Those whose injury was occasioned by irradiation designed to destroy some lesion of the skin or some of the cutaneous appendages (hair). (4) Those injured by radiation dermatitis following treatment of some deep-lying condition; familiar locations are the abdominal wall and the back. (5) Irradiation for infection at times was formerly overdone and produced damage.

Irradiated skin shows considerable sensitivity to other irritants such as chemical, mechanical, and bacterial agents, to further irradiation and to the effects of sunlight. The author states it seems highly illogical to treat roentgen dermatitis with further irradiation as has been done in some instances with the use of radon ointments or beta radiation.

The pathologic picture of irradiation dermatitis with its fibrosis, atrophy, telangiectasis and obliterating endarteritis is well recognized by all pathologists.

Radiation carcinoma is more frequent after prolonged minimal exposure to the soft alpha and beta rays and is usually the squamous cell variety, although occasionally a basal cell type may form. The incidence of malignancy in irradiation dermatitis of the hands is definitely higher than that evidenced by irradiation dermatitis in general. Time factor is important in that if radiodermatitis lasts long enough a carcinoma will eventually develop in it.

Reactions to irradiation of the skin may take on one of two forms, the acute reaction which follows quickly after the exposure to large doses of roentgen rays, radium or atomic radiation and the chronic reaction which may appear either as a sequel to the acute reaction or as a delayed response to repeated minimal exposures. Certain areas of the skin, particularly the finger tips, tend to thicken and crack, the nails become brittle, irregular and crack easily and are prone to develop foci of low grade chronic infection. Carcinoma will be found in small ulcers or keratotic plaques.

The treatment of irradiation dermatitis of the hands is removal of the involved skin. This must be done early before ulceration and carcinomatous breakdown occur. The problem of treatment of lymph node involvement is still unsettled; however, the author states that whenever the lymph nodes are palpably enlarged a radical dissection is indicated.—*J. H. Gilmore, M.D.*

JÖRG, M. E., and AGUIRRE, J. A. Nuevas contribuciones al problema de la falta de eliminación del dioxido de torio coloidal empleado como medio de contraste radiológico. (New contributions to the problem of faulty elimination of colloidal thorium dioxide when used as a roentgenological contrast medium.) *Radiologia*, Panamá, March 1951, *1*, 79–87.

In confirmation of previous studies, the authors present 2 additional cases showing delayed elimination and discuss the dangers inherent in the use of thorium dioxide for diagnostic purposes. In the first case, a routine ascending pyelogram was made in 1940, using colloidal thorium as a contrast medium. Fifteen months later, a roentgenogram of the abdomen disclosed shadows of metallic density above the renal areas, which were not present prior to the examination with thorotrast. In the second case, an appendectomy was performed in 1933. Six months later, thorium dioxide was administered intravenously because of suspected liver disease. At operation pus and calculi were found in the gallbladder. Following surgery, roentgenograms disclosed thorium dioxide in the liver and gallbladder. In 1950, seventeen years after its administration, a roentgenogram showed a persistence of the thorium deposits in the liver, spleen, ganglia and paravertebral regions.

Because of its irritative qualities and radioactivity, the authors advise that other media rather than thorotrast should be used for diagnostic purposes.—*M. M. Friedman, M.D.*

RADIATION THERAPY

ALLEN, J. GARROTT, MOULDER, PETER V., and ENERSON, DANIEL M. Pathogenesis and treatment of the postirradiation syndrome. *J.A.M.A.*, March 10, 1951, *145*, 704–711.

The postirradiation syndrome was studied in dogs both as to its manifestations of hemorrhage, infection, anemia and malnutrition and as to its treatment. The lethal dose of whole body roentgen irradiation for dogs is 300 to 325 r and is probably close to that of man's. Doses of 450 r were used in this study.

Hemorrhage was present in all dogs in many and varied locations, but probably was not the most frequent cause of death. Its cause is complex. Thrombocytopenia is invariable and severe between the eighth and twelfth days and is not corrected by transfusion. Clotting time was usually prolonged but might be normal terminally. Prothrombin time was not significantly altered. The presence of a heparin-like substance was suggested in some animals. Protamine sulfate and toluidine blue, particularly the latter, are effective in many cases. Blood transfusion was without effect as far as bleeding was concerned. Rutin and ascorbic acid are suggested on theoretical grounds to protect the capillaries.

Infection in irradiated cases is probably a combined result of increased number of portals of entry due to injury, leukopenia and low antibody titer. Severe leukopenia occurs in a few days and is not altered by transfusion. Animals were given passive transfer of antibodies using antidistemper serum, tetanus antitoxin, gas gangrene antitoxin, and frequent transfusions, all without effect on survival. Aureomycin increased average survival time from eleven days for untreated dogs to seventeen days for treated dogs, but none survived. The combination of aureomycin and frequent transfusions gave significant prolongation of survival time with 2 of 11 dogs still living after eighty-two and ninety-six days.

Anemia was acute and severe if the animal survived ten to fourteen days. The cause is not entirely explainable on the basis of hemorrhage, lysis, blood volume changes, agglutination nor increased phagocytosis. Treatment is transfusion. Secondary anemia occurs between the fourth and sixth weeks if the animal survives and is probably due to marrow hypoplasia. Treatment is both by diet and by transfusion.

Nutrition becomes complicated one to two weeks after exposure because of diarrhea, anorexia and vomiting, and parenteral feeding is necessary. There are ulcerations and edema of the gastrointestinal tract, the nitrogen excretion in the urine is increased and the serum proteins are decreased, particularly the serum albumin.—*H. J. Klos, M.D.*

DAUBRESSE, E. Une méthod de traitement des staphylococcies du visage; le rôle de la radiothérapie. (Method of treatment of staphylococcal infections involving the face; role of radiotherapy.) *J. belge de radiol.*, Dec., 1949, *32*, 249–259.

There are several manifestations of staphylococcal infections involving the face of which the commonest is acne vulgaris. The object of this article is to establish clearly the etiological factors and to outline an effective method of treatment.

The development of infectious foci at the level of the skin of the face reflects a deficiency in the defense mechanism of the body. Inflammatory reactions are mostly due to staphylococcal infections which must be treated from the onset, with local antiseptics and injections of heavy metals. Poor carbohydrate metabolism contributes largely to lowering the immunity threshold of the body and must be corrected. Estrogenic substances are a useful adjunct in young women.

A predominant part is played in the treatment of acne vulgaris by low voltage roentgen therapy (60–90 kv.) with fractional doses, up to 600–800 r to each area given over a period of six to ten weeks. Excellent therapeutic results have been observed in staphylococcal infections of the face when the combined measures outlined above have been properly applied.—*Jean Bouchard, M.D.*

Fuchs, Georg. Die kombinierte Röntgen-Kurzwellen-Therapie entzündlicher Erkrankungen. (Combined roentgen and short wave therapy of inflammatory diseases.) *Strahlentherapie*, 1951, *84*, 459–466.

Until two years ago inflammatory conditions were treated at the Kaiser Franz-Joseph-Spital in Vienna by roentgen irradiation with small doses according to the method of Heidenhain and Fried. Since then the author has employed a new method consisting of an association of roentgen therapy (with even smaller doses) and short wave therapy in various combinations. The very acute inflammatory processes, as for example, furuncles and carbuncles in the initial stage, are treated with short wave application followed immediately by roentgen irradiation with doses of 10–30 r. In the subacute and chronic cases the short wave therapy and roentgen therapy are alternated on successive days. In chronic joint lesions good results are obtained from a combination of short wave therapy applied the first and second days and roentgen therapy given on the third day. The method lends itself to considerable individualization, depending on the type of inflammation and the clinical course of the disease.

Roentgen rays of three qualities are employed. In superficial lesions of the skin 100 kv. with 3 mm. Al; in somewhat deeper lesions, as for example lymphadenitis, 120 kv. with 5 mm. Al; and in all bone and joint lesions 150 kv. with 5 mm. Al are used. The short wave therapy is carried out with waves of 6 m length by following the technique of Schliephake-Liebesny with personal adaptation to various conditions. Although superficial infiltrations can conveniently be treated with unipolar application, the author prefers in all instances the bipolar applications with electrodes of various sizes to obtain a more suitable field distribution. The distance of the electrodes from the skin is 2 cm. in superficial lesions and 10 cm. in deep-seated lesions, as for example pneumonic infiltrations.

The total number of patients treated during the two year period was 86. The author analyzes in detail the results obtained in these patients, and includes brief résumés of the more interesting cases to illustrate the salient points of treatment and clinical response.

The conclusion is reached that the combined method is of definite value in the acute circumscribed inflammations as well as in the chronic articular processes. If a careful technique is used no untoward effects need be feared. Since the action of the short waves is different from that of the roentgen rays, the combined use of the two agents leads to a broadening of the therapeutic effect with a corresponding improvement in the results.—*T. Leucutia, M.D.*

Buschke, Franz, and Cantril, Simeon T. Radiation therapy of carcinoma of the vagina. *Radiology*, Feb., 1951, *56*, 193–201.

Carcinoma of the vagina should not be considered incurable. Prognosis in cases treated by adequate radiation therapy compared favorably with that of cancer of the cervix with comparable extension of the disease.

Reported are 10 cases of carcinoma of the vagina treated between 1942 and 1946. Six of these patients are well without clinical signs of active disease for periods of three to six and one-half years. For evaluation and comparison of results the classification proposed by Courtial was followed. From the results obtained and the summarized results of radiation therapy at the Institut du Radium in 31 cases, it is concluded that insufficient external irradiation is responsible for the poor results in many instances.

Treatment consisted of radical external roentgen therapy complemented by local radium application. Exact details of treatment are given. Using 800 kv. radiation in all except one of these cases, roentgen therapy was given through four oblique fields, centered toward the vagina. An average of about 3,400 r/skin per field was given in forty-one to sixty-eight days. This was followed by local application of radium, with the estimated maximum dose to the vaginal wall ranging from 4,000 to 19,000 gamma roentgens, the 10,000 gamma roentgen level being exceeded in 4 of the 10 cases. In no case did a fistula develop even when there was massive involvement of the rectovaginal septum. No marked early or late reaction of the bladder was seen.—*A. W. Sommer, M.D.*

DiPalma, S. A new colpostat for the radium treatment of carcinoma of the cervix. *Am. J. Obst. & Gynec.*, Sept., 1950, *60*, 680–683.

In the new applicator, the author has taken the ametal rubber inverted T and added to it, at the level of the center of the cross ovoid, two ametal rubber arms at the end of which an ovoid is attached. In this manner all the centers of activity are contained in a single applicator consisting of uterine tube and three ovoids, each constituting an integral part of the applicator (Fig. 1). The ametal rubber arms joining the lateral ovoids to the cross ovoid are of sufficient thickness to provide the necessary rigidity to prevent positional changes. They are thin enough to permit bending back at the time of insertion in the vagina. Ametal rubber is not hard, but

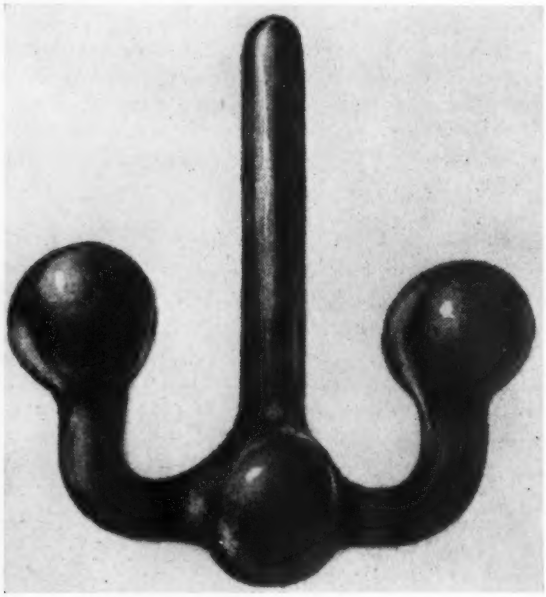

FIG. 1. Colpostat for radium treatment of carcinoma of cervix. (Reproduced by permission from DiPalma, S. *Am. J. Obst. & Gynec.*, Sept., 1950, *60*, 680–683.)

soft and pliable, yet provides rigidity with thickness.

A conservative conization of the cervix is done, the applicator is introduced and placed in the position. It is not necessary to carry out the conization of the cervix. The author prefers it for two reasons: first, the cross-ovoid can actually be placed in the cervix; and second, the extent of invasion may be ascertained, quite often, grossly.

When pressure is applied by packing, the lateral ovoids are pushed laterally and upward, thus bringing them more closely to the parametrial area. The proper position of the applicator is maintained throughout the treatment period by packing.

The most commonly used distribution is as follows: three tubes of 10 mg. each in the uterine tube; one tube of 5 mg. in the cross-ovoid; and one tube of 10 mg. in each lateral ovoid. This distribution is in accordance with the original Regaud method. Dosages of 8,000 to 10,000 millicurie hours over periods of from six to ten days are employed with continued application and no interruption.

The most satisfactory applicator has a tube length of 5 cm. and an over-all length of 5.5 cm., the diameter of the cross-ovoids is 1.7 cm., and the actual length of each of the three ovoids is 3.0 cm. The active length of the tube in each ovoid is 1.8 cm. The important dimension is the distance between the lateral ovoids. In the applicator here illustrated this distance is 5.0 cm. (Fig. 1).

With the dosage and distribution described, the amount of radiation at the vaginal wall remains within limits of tolerance. Though the dose at the cervix is apparently high, no damage is done since the cervical tissues can absorb extremely high dosages.

Attention is directed to the absence of so-called intense radiation reactions following the technique here described. The bladder and rectum are practically automatically protected when the applicator is inserted properly. The distances to the rectal and bladder mucosas from the active tubes are safe and maintained so during the entire treatment period. Severe proctitis, cystitis, vaginitis, followed by breaking down of tissue, do not constitute expected reactions if the treatment is performed properly. The applicator is easily handled due to its light weight and can be inserted accurately by anyone versed in gynecological procedure.—*S. T. Tager, M.D.*

DAUBRESSE, E. Une nouvelle technique de traitment du cancer du rectum par le radium et le rayon X. (New technique for the treatment of cancer of the rectum with radium and roentgen rays.) *J. belge de radiol.*, Dec., 1949, *32*, 260–275.

The author disagrees with Lamarque and others who believe that radium treatment of cancer of the rectum should be abandoned, and he believes that adequate intracavitary radium therapy is feasible in cancer of the rectum.

He considers that cylindrical cell carcinoma of the rectum is generally accepted as radiosensitive and that both radium and roentgen therapy are capable of destroying the cancer cells of atypical cell, mucous cell or glandular type of carcinoma of the rectum. Low voltage contact roentgen therapy appears to be inadequate for the treatment of tumors of large volume.

Cancer of the rectum must be made readily accessible for adequate irradiation and a preliminary colostomy is often necessary. During the period of treatment the patient must be fasting and maintained on intravenous feeding. Under spinal anesthesia the anal sphincter is dilated and long 2 mg. radium needles are implanted. The rectum is well packed with gauze and the anal canal is closed with strong

sutures. If necessary, because of the size of the tumor, a two-stage implantation of radium needles with an interval of three to four weeks may be performed.

Supplementary external roentgen therapy is used to treat neoplastic spread to adjacent structures and lymphatics, through anterior and posterior fields.—*Jean Bouchard, M.D.*

Wilder, Helenor Campbell, and Maynard, Russell M. Ocular changes produced by total body irradiation. *Am. J. Path.*, Jan.–Feb., 1951, *27*, 1–19.

The ocular changes produced by total body irradiation were studied in animals as follows: (1) 21 goats and 31 pigs receiving varying amounts of total body ionizing radiations at Operation Crossroads; (2) 24 pigs receiving total body roentgen-irradiation, and 4 fetuses from roentgen irradiated sows; (3) 24 control animals.

The eye changes produced by total body irradiation from the Bikini experiment and total body roentgen irradiation were essentially the same. Many of the manifestations were similar to those seen in other organs of animals receiving large doses of radiation. These consisted of hemorrhagic phenomena in the conjunctiva, choroid, retina and anterior chamber. Bacteria were found in the ciliary body and choroid in several of the animals.

The most consistent finding was the occurrence of small vacuoles in the cortical region of the lens which was found in 57.5 per cent of the eyes examined from the Bikini experiment and in 58 per cent of the eyes examined from the roentgen irradiation experiment. However, in the normal control group its occurrence was found in 65 per cent of the eyes examined. The eyes of fetuses from sows which had received 400 to 600 r total body irradiation showed more extensive damage which included periretinal edema and massive subretinal hemorrhage with complete retinal detachment in several instances. The lenticular changes were also more severe with advanced degeneration of the deeper fibers.

The authors conclude that for the most part the ocular changes produced by radiation were the result of bone marrow depression and secondary systemic changes rather than a direct effect of radiation. Vacuolization of the lens was present in many of the irradiated animals but was also fourd in the controls and therefore was not considered a specific manifestation of the irradiation. The marked destructive ocular changes produced in the irradiated fetuses were in contrast to the minimal changes found in the adult animals. The exposure occurred when the tunica vasculosa lentis was still present, signifiying a period of most rapid growth and metabolic activity. The lens would therefore be most susceptible to deficiencies of nutrition. Cataract formation was not seen. However, all animals in this study died or were killed within six months of exposure and it may be that a prolonged study of animals receiving sublethal irradiation would reveal the development of cataracts.

Although the secondary effects of ionizing and roentgen irradiation were similar in the eyes of both pigs and goats, there were no ocular changes which could be attributed unequivocally to irradiation.—*J. P. Storaasli, M.D.*

Green, Anthony. Low voltage x-ray therapy with a beryllium window tube. Part I. Introduction and advantages. *Brit. J. Radiol.*, March, 1951, *24*, 134–135.

The usual arrangement for administration of Grenz rays includes a very fragile Lindemann window. A tube has been manufactured with a much more sturdy beryllium window. This tube operates with 4 to 50 kv. and current up to 50 ma. The dose rate is 60,000 r/min. at a distance of 10 cm. The most convenient method of describing the penetration is by designating the depth at which 50 per cent of the beam has been absorbed.

One advantage of the beryllium window tube is the wide range of penetration available. At one extreme, 50 per cent of the intensity is absorbed in 0.14 mm. of tissue, and at the other extreme, in 3 cm. of tissue. The high dose rate permits use of a long focal distance when the softest rays are not necessary, and thus it is useful for superficial treatment of wide areas. Also, it is possible to treat rapidly, as, for example, a hemangioma in a child in five seconds. The very soft rays available permit an adequate dose to the surface of the skin without injury to the hair follicles which are at a deeper level. Added intense doses may be administered to areas of skin which have had previous treatment, as in lichen planus, with much less chance of late effects. A further advantage is that low integral doses are given to large fields with relatively high incident roentgen doses.—*E. F. Lang, M.D.*

Jennings, W. A. Low voltage x-ray therapy with a beryllium window tube. Part II. The achivement of optimum depth dosage distributions—from the physical standpoint. *Brit. J. Radiol.*, March, 1951, *24*, 135–142.

Measurement of the physical characteristics of these long wavelength radiations is difficult. The author used a modification of the accepted ionization technique, with the soft qualities being transmitted by a fine nylon grid electrode, and deriving the high dose rate readings.

Charts are presented relating the kilovoltage, filtration, target-skin distance, field size, and the radiation penetration. This latter term is expressed as the depth at which the dose is one-half of the surface dose, and also the depth at which the tissue dose is one-tenth of the surface dose.

It was found that treatment given with a low

voltage and high filtration to produce a given penetration led to a beam which decreased rapidly in intensity beyond the desired thickness of irradiated tissue; while a higher voltage and less filtration to produce the same depth dose, decreased more slowly, and was therefore less desirable. Practically, changes in field area affect the depth dose only slightly, and are generally ignored. On the other hand, changes in the target-skin distance are important because of the filtration effect of the air when dealing with soft beams.

An interesting and valuable composite graph is presented which relates the most desirable and least desirable fall off ratio to the kilovoltage and simultaneously to various dose rates, from 100 to 100,000 r/min.—*E. F. Lang, M.D.*

HENDTLASS, R. F. Low voltage x-ray therapy with a beryllium window tube. Part III. Technique reactions and results. *Brit. J. Radiol.*, March, 1951, *24*, 142–147.

In using this type of treatment, the beam is defined by lead foil masks which can be easily cut and moulded to body contours. The distance must be carefully measured, as the dose rate and quality are affected by this factor. The high dose rates available are of considerable value, especially in the treatment of children.

Following irradiation there are three waves of erythema. In the case of 80 kv. therapy the second wave is usually the only one observed, and the third is rarely seen. With the low voltages used with the beryllium window tube, the third wave is of greater importance, and it develops between thirty and sixty days after the treatment. The first and second waves frequently overlap. When the third wave of erythema advances to moist desquamation, the pattern of the reaction is constant, despite some irregularity in the physical variation in intensity over the field. This phenomenon is explained on the basis of differential effect on the small blood vessels. This supposition is strengthened by the observation that the maximum skin reactions occur at depths of 1 and 5.5 mm. below the skin surface with various penetrations. These two levels are also approximately those of the vascular plexuses of the skin. It is important to remember that if more than 500 r is administered, a second dose cannot be given before two months because of the third wave of erythema.

The restriction of most of the beam to a thin layer permits safe treatment of lesions near epiphyses, or of scrotal dermatoses. The treatment of large areas of skin is much facilitated. Rapid intracavitary irradiation can also be administered.—*E. F. Lang, M.D.*

KEPP, RICHARD KURT, MÜLLER, KURT, and REICH, HERBERT. Die Bedeutung des Zeitfaktors bei Bestrahlung der menschlichen Haut mit schnellen Elektronen. (The significance of the time factor in irradiation of the human skin with fast electrons.) *Strahlentherapie*, 1951, *84*, 225–244.

Kepp, Müller and Paul formerly published certain data on the skin reaction obtained with fast electrons which were produced by the 6 mev. betatron of the Siemens-Reiniger-Werke A. G., installed at the University of Göttingen. It was found that when equal surface doses were given, the skin reaction was considerably stronger with fast electrons of 3.5–4.0 mev. energy than with roentgen rays of 200 kv. energy. This greater intensity was attributed to the relative increase of the depth dose up to a certain peak immediately underneath the skin in the case of the fast electrons, whereas the depth dose of the roentgen rays shows a continuous uninterrupted fall. It was further found that the intensity of the reaction rose with increase of the surface dose, increase of the electron energy and, surprisingly, also with increase of the dose rate. In connection with this latter it was observed that, if a certain dose was administered at a rate of 1,000 r/min., the corresponding skin reaction was considerably higher than when it was administered at a rate of 300 r/min. under otherwise identical conditions.

In the present article the authors give the results of a series of new experiments which they performed in an attempt to study more accurately the significance of the time factor in the protraction of the irradiation with fast electrons. Several areas of 2.4 cm. in diameter on the thighs of 14 persons were irradiated through windows of lead of 0.2 cm. thickness with 3 mev. electrons. The range of the tissue penetration of these electrons was 12 mm. and the depth dose rose to a maximum of 140 per cent of the surface dose at 4 mm., after which it rapidly fell to practically zero at 12 mm. The skin reaction was observed daily at the same hour for at least forty days, the photometer of von Witte being used to measure the variations in the intensity of the erythema. Seven persons received total doses of 600–1,300 r per area given at rates varying from 100 to 1,600 r/min. In all instances, the administration of an equal surface dose with higher dose rates resulted in a correspondingly stronger skin reaction. An equal skin reaction was observed when a surface dose of 600 r was given at a rate of 1,500 r/min., or a dose of 800 r at a rate of 900 r/min., or finally a dose of 1,000 r at a rate of 300 r/min. For control purposes 7 persons were irradiated with the stated surface doses at the specified dose rates, and equal skin reactions were obtained.

According to the authors, the greater influence of the time factor on the skin reaction when irradiating with 3 mev. electrons as compared to irradiation with 200 kv. roentgen rays is due to the different type of ionization. In the case of fast electrons, the ionization produced in the tissues is less dense and there-

fore the recovery of the cells from the fewer hits is faster, whereas hard roentgen rays lead to the emission of large clusters of ions resulting in greater ion density and a considerably slower biologic recovery.

The practical value of the aforementioned experiments lies in the fact that by using low dose rates it is possible to irradiate with fast electrons a certain deep-seated lesion with less damage to the skin than can be accomplished with the conventional 200 kv. roentgen therapy.—*T. Leucutia, M.D.*

Beare, J. Martin, and Cheeseman, E. A. A localized outbreak of tinea capitis (M. audouini) in Northern Ireland. *Arch. Dis. Childhood*, April, 1951, *26*, 149–157.

An extensive local epidemic of tinea capitis occurred from June, 1948, to August, 1949, in which 368 children out of a population of 3,000 under the age of seventeen years were infected, from a total population in a municipality of about 12,000 inhabitants.

Rather interesting observations are made on the rate of development of the epidemic, the age and sex incidence, and comparison of the members involved in various schools.

Of the 368 infected children, 278 were submitted to roentgen epilation. Of these, 266 were cultured and in 252 cases *Microsporon audouini* was grown. In the other 14 no pathogen was isolated. During the course of mass epilation, there was a necessary wait for some cases and during this time a considerable number improved to the degree that epilation was not necessary. Eighty-seven cases were considered to have had spontaneous cures, having had no specified treatment, although some had had various home remedies. Only 1 case which was successfully epilated suffered a reinfection. The reinfected area was away from the areas originally involved, and the secondary infection was cleared by extensive manual epilation.

The value of Wood's light in the detection of infection in children as well as the impression that the most important clinical sign of the disease is dandruff is emphasized.

An interesting account is given of a pair of infected twins. From one a positive culture was obtained and roentgen epilation ordered, but the mother refused for a period of nine months, after which she returned with the patient who now was found to be free of infection. The culture of the second twin grew no pathogenic organism and therefore this twin was treated with local applications of ointment. After nine months, on examination with Wood's light, she was still found to be infected. A positive culture was obtained, and the tinea subsequently cleared by roentgen epilation. During this time the mother apparently made no attempt to keep separate the clothing, combs, etc. of these two children.—*P. R. Dirkse, M.D.*

Wolf, Bruno. Strahlentherapeutische Beeinflussung der Hochdruckkrankheit. (The influence of radiation therapy on hypertension.) *Strahlentherapie*, 1951, *84*, 559–566.

Thirty-four patients (11 male, 23 female; ages 42–77 years) with hypertension were observed for two years after radiation therapy. A favorable effect was noted on the level of the blood pressure, but more particularly on the subjective symptoms: at the end of three months, 72 per cent of the patients showed a material subjective improvement over their preirradiation state, and, after twenty-two months, this improvement persisted in 12 of 20 patients (60 per cent).

A dose of 300 r was administered three times at intervals of eight to fourteen days through a 10 by 15 cm. port directed at the 5–12th thoracic sympathetic ganglia (200 kv., 15 ma., with 1 cm. Cu at 30 cm. focal skin distance). This series was repeated "according to the reaction" in six to eight weeks.

Seven cases showed no depression of blood pressure, even after the second series. The typical course of the others was a depression of blood pressure in two to four weeks. The greatest depression occurred in one to four months and was maintained for several months. Then gradual increase of the pressure ensued so that, at eighteen months, values only slightly below the preirradiation levels were observed. Of 13 cases with only slight depression of blood pressure, or with early re-evaluation, 11 showed a renewed or further depression of pressures after one to three additional treatments.

The beneficial effect of irradiation is attributed to alterations in nerve cell metabolism induced by changes in ion concentration and cell permeability. These changes are presumed to give rise to centripetal impulses from the irradiated vegetative nerve centers to the mid-brain, impulses which depress blood pressure.—*H. G. Moehring, M.D.*

Lesende, Manuel. Consideraciones clínicas y roentgenterapia en las adenitis tuberculosas. (Clinical considerations and roentgen therapy in tuberculous adenitis.) *Radiología*, Buenos Aires, March, 1951, *12*, 33–38.

The author deals extensively with the clinical picture, differential diagnosis and clinical classification of tuberculous adenitis. He also gives a detailed description of the various methods used for its treatment, paying special attention to the different techniques of roentgen therapy employed by several investigators.

His own series includes 120 cases from the Service of Prof. Maissa of Hospital Ramos Mejía. A cure by roentgen therapy alone was obtained in 90 per cent of the cases. Patients with involvement of the intrathoracic and abdominal lymph nodes were omitted

from the study so that the excellent results secured refer only to cases with tuberculosis of the peripheral lymph nodes.

The following technique was used:

(1) Early tuberculous adenitis. A protracted dose of 450 r was given in 10 days, starting with 100 r.

(2) Advanced tuberculous adenitis. A protracted dose of 700 r was given in 12 days, starting with 150 r.

(3) Caseous tuberculous adenitis. In this form the irradiation was started with an anti-inflammatory dose of 50 r which was then gradually raised as the healing progressed. In case of abscess formation, the pus was aspirated from the lymph node with a small needle and the anti-inflammatory treatment continued. The same procedure was followed if the breaking down of the lymph node resulted in fistulization. After the acute inflammatory stage had subsided the irradiation was continued with the technique described in (2).

(4) Fistulous tuberculous adenitis, complicated by ulcers with keloid borders. In this form the treatment was given by administering 120 r until, in certain cases, a protracted dose of 900–1,000 r was reached.

All patients were re-examined four to six weeks after the completion of the treatment and if the lesion was not entirely healed a complementary series of irradiation was undertaken.

The author concludes by stating that roentgen therapy is the most effective method for the treatment of tuberculous adenitis.—*T. Leucutia, M.D.*

MOULINARD, J. Le traitement par le radium des reliquats adénoidiens. (Méthode de Crowe-Burnam). (The treatment of residual adenoid tissue by radium [Crowe-Burnam method].) *Ann. d'oto-laryng.*, 1951, *68*, 72–86.

Radium acts on adenoid tissue in the lateral nasopharyngeal walls where it is inaccessible to the adenotome. Hypertrophy of this tissue causes deafness by obstruction of the eustachian orifice; infection may cause recurrent otitis media or catarrhal inflammation of the eustachian tube.

The Crowe-Burnam applicator contains 50 mg. of radium over an active length of 1.6 cm., filtered by 0.3 mm. of monel metal. With this filtration, which is the most important physical characteristic of the applicator, 93 per cent of the emitted energy is in the form of beta radiation which is almost completely absorbed in 3 mm. of tissue. The output is 370 rep per minute.

The author made tests with this applicator by contact applications on the forearm of 15 subjects. After an application of 5, 10 or 20 minutes, an erythematous reaction limited to the active length of the radium appeared within a few hours and subsided in two to eight days. After a latent period of two to three weeks, during which time the skin appeared normal, a second reaction developed, characterized by marked erythema with an exudate and lasting two to three weeks. After one year, only a thin, lightly pigmented scar was visible.

The reactions of the nasopharyngeal mucosa in contact with the applicator are similar in character and in timing. There is a sharply localized epithelitis with destruction of the more radiosensitive submucosal lymphoid tissue. An examination performed during the latent period when the mucosa appears normal may be interpreted as a negative response to the treatment. Normally, an application for eight and one-half minutes on each side results in the disappearance of the lymphoid follicles and engorged vessels within one month.

The author stresses the anatomical limitation of this method to the mucosa in contact with the applicator for a depth of 3 mm., and therefore its practical usefulness for the region of the eustachian orifice. For infection in the eustachian tube, external roentgen therapy is indicated. Both methods may be employed together. Irradiation of the entire nasopharyngeal cavity with radium is not recommended because of the discomfort and inconvenience it entails and also because it is not practicable for children. The author also warns of the dangers to the medical personnel in the use of the Crowe-Burnam applicator because of cumulative radiation exposure of the fingers and the entire body from repeated handling.—*S. M. Silverstone, M.D.*

SÖDERBERG, LENNART. On the treatment of Dupuytren's contracture. *Acta orthop. Scandinav.*, 1951, *20*, 184–199.

The author first reviews the progress in treatment of Dupuytren's contracture since Cooper began in 1822 treating the condition surgically. His own series consists of 37 men and 3 women. Five of these patients had both hands treated. The surgical technique is explained. He then mentions a procedure which he finds has contributed to the satisfactory results, *i.e.*, postoperative roentgen therapy.

All except 5 patients were given roentgen treatment two or four weeks after operation. The dose varied between 700 and 800 r and was administered in fractions of 175–215 r at intervals of three to five days over a period of two to three weeks. The factors were 165–175 kv., 4 mm. Al, 6–7 ma., 40 cm. skin target distance.

This dose represents a resorption treatment and has aimed at diminishing the formation of scar contracting fibrous elements in the skin and subcutaneous tissue. As a preventive measure against secondary keloid formation in the epidermis he feels it is probably inadequate.

The results were excellent in 55.6 per cent, fair in 37.8 per cent and poor in 6.6 per cent of the cases.

They were very good as shown in chart comparing with the results of other authors.—*R. D. Moreton, M.D.*

Strauss, Hans. Über die Röntgenentzündungsbestrahlung mit Kleinstdosen. (Roentgen irradiation of inflammations with minimal doses.) *Strahlentherapie*, 1951, *84*, 554–558.

Roentgen radiation doses of 10–25 r daily produced better therapeutic results than previously employed larger doses.

One hundred and thirty-two cases of abscess of the sweat glands were treated by roentgen therapy. The first group of 61 cases received 200 r per treatment, to an epilation dose of 600 r within the first week. Doses of 150–200 r were repeated at weekly intervals so that dosage finally totalled 1,500 r in many instances. A second group of 33 cases received 50 r per treatment, to an average total dose of 480 r. The third group of 38 cases was treated with "minimal" doses of from 10–25 r (usually daily) to an average total dose of 148 r.

Ripening of the abscess and the spontaneous drainage of pus occurred after the same length of time in all three groups. However, healing and total time under treatment were shorter with the smallest doses. Also, healing without abscess formation was more frequent, and relief of pain better with the smallest doses.

Epilation was noted in the more severe cases of long duration, even when only the minimal dosage plan was utilized. This is attributed to destruction of the hair follicles and roots by the severe inflammation and bacterial toxins, similar to the "toxic alopecia" of severe infectious diseases.

Similarly, observation of a series of 35 cases with furuncles or carbuncles showed that the minimal dosage schedule was more efficient in producing adsorption of the inflammatory infiltration about the affected site. The use of small doses of radiation was particularly advantageous in patients with multiple furuncles spread over large areas.

Treatment of 11 patients with tuberculous iridocyclitis with three doses of 15 r each at intervals of three days yielded good results.—*H. G. Moehring, M.D.*

Fuchs, Georg. Zur Strahlenbehandlung der Arthrosis deformans. (Radiation therapy of arthrosis deformans.) *Wien. klin. Wchnschr.*, April 20, 1951, *63*, 295–296.

The author uses a combination of roentgen therapy and short wave treatments, given on alternating days for two to four weeks. The doses are 10 to 30 r at one seance, the whole series being repeated in six months if necessary. Of 40 cases so treated, 16 showed marked improvement, 20 moderate improvement and 4 showed no change.

The author believes his method to be superior to roentgen therapy alone, as smaller doses of roentgen rays combined with short wave treatments are equally effective and no permanent roentgen damage is to be feared.—*K. E. Matzinger, M.D.*

Meginnis, Paul J., and Lutterbeck, Eugene F. Roentgen therapy of inflammatory conditions affecting the legs of thoroughbred horses. *North Am. Veterinarian*, 1951, *32*, 540–546.

Lameness of thoroughbreds is usually caused by traumatic inflammations such as acute or chronic bursitis, tendinitis, tendosynovitis, arthritis or periarthritis.

Stimulated by the beneficial effect which is observed following roentgen treatment of similar conditions in the human the authors decided to try the same procedure in the equines. They have secured through the courtesy of the management of the Hawthorne Race Track in Chicago two stalls, separated by a partition, the lower portion of which had been taken out to a height of about 3 feet. One stall was used for the purpose of housing the equipment and the other for confinement of the patient during irradiation. Since only the fetlocks, metacarpals and knees were treated, roentgen rays of medium penetration were employed which were directed horizontally to the respective areas while the horse was standing in the adjacent stall rather tightly enclosed. The shock proof roentgen tube head was placed on casters to facilitate ready change in position if the patient moved forward or backward. The irradiation was carried out with the following factors: 140 kv. 0.25 mm. Cu plus 1 mm. Al, a half-value layer of 0.5 mm. Cu, 8 ma., 20 r/min., and a distance of 40 cm. In most cases a dose of 120 r in air was given per seance, once or twice weekly, until a total dose of 480 to 720 r had been reached.

During the racing season of April to November, 1950, thirty-nine thoroughbreds between two and eleven years of age were treated altogether, several among them being irradiated over more than one area. The authors give a detailed tabular compilation of the results obtained in the (1) fetlock, (2) metacarpal and (3) knee areas and include three case reports, one each for the illustration of a (a) good, (b) fair, and (c) negative result. They stress that clinical and roentgenographic examinations are necessary before and two to six weeks after the completion of the course of irradiation if the result is to be properly evaluated.

In summarizing the results, the authors state that of 60 areas treated in 33 animals, 39 areas (65 per cent) showed good improvement, 11 areas (18 per cent) moderate improvement and 10 areas (17 per cent) no improvement. The best results were obtained in acute bursitis of the fetlock, early bucked shins and acute inflammations of the knee joint. The conclusion is drawn that roentgen therapy

is of definite value in the treatment of lameness of race horses.—*T. Leucutia, M.D.*

STEIN, JUSTIN J., COSTOLOW, WILLIAM E., and MELAND, ORVILLE N. The management of breast cancer: surgical treatment and irradiation. *J. Internat. Coll. Surgeons*, March, 1951, *15*, 299–308.

The authors stress the importance of the cytologic diagnosis of breast cancer and of its proper staging. They present their method of staging, which is similar to the Portmann method. Besides the stage of the disease, the authors discuss such intangibles as the resistance of the host to the clinical course of this lesion. Tables are presented giving the survival times of the patients with cancer of the breast in various stages. Comparison is made between surgery only, preoperative irradiation plus surgery and surgery plus postoperative irradiation.

The preoperative roentgen therapy consists in the use of two tangential portals for the breast proper, a single portal for the infraclavicular and supraclavicular areas treated with the clavicle as its center, and a direct axillary portal. Each of the four portals receives 100 roentgens daily, employing 185 to 250 kv.; target-skin distance 50 cm; half-value layer 0.9 mm. to 2 mm. copper; size of portal varies from 10 by 10 to 10 by 15 cm. All areas are treated six times each week. The total dose delivered to each portal is 2,000 roentgens, measured in air. Operation is performed four to six weeks after completion of the roentgen therapy. The cutaneous reaction is usually intense, but subsides with practically no changes in the skin and operation is not interfered with except by the delay in time.

Postoperative roentgen therapy is usually begun ten days to three weeks after surgery. This therapy is given if no preoperative irradiation has been administered. If adequate preoperative irradiation has been given, no further therapy of this kind is indicated. The roentgen rays are directed into the axilla through one portal and into the supraclavicular area through another portal; 150 r is given daily to each portal. Upon reaching 2,000 r, measured in air, on these portals, the skin of the anterior chest wall in the operative area is divided into two portals and treated, using the following factors: 100 kv., T.S.D. 30 cm.; 0.25 mm. copper and 1 mm. aluminum filter. One of the two portals is treated daily with 350 r until 1,050 r has been given to each portal. The factors for the therapy directed at the axilla and supraclavicular areas are the same as those used for preoperative irradiation.

The results obtained show that preoperative irradiation has not produced any significant increase in five year survivals as compared to surgery alone or surgery plus postoperative irradiation. The authors therefore conclude that immediate radical operation is the treatment of choice for cancer confined to the breast. Immediate radical operation with postoperative roentgen therapy is the treatment recommended for cancer of the breast with ipsilateral lymph node involvement, with or without local cutaneous involvement.—*T. J. Wachowski, M.D.*

COSTOLOW, WILLIAM E., and NOLAN, JAMES F. Factors influencing prognosis in the treatment of carcinoma of the cervix uteri. *Am. J. Obst. & Gynec.*, March, 1951, *61*, 548–556.

The authors' purpose in carrying out this study is to evaluate some of the characteristics of the carcinoma of the uterine cervix in the light of the influence they may have exerted upon the eventual outcome of a group of patients in their experience.

There were 963 patients in the group of whom 703 had no former treatment, 97 were post irradiation, 61 post hysterectomy, and 102 with carcinoma of the cervical stump. Ninety-seven per cent of the treated patients were followed five years or more. The absolute five year survival rate was 40 per cent and the relative one 48 per cent.

The League of Nations classification is used for the clinical staging and Broders' classification for the microscopic grading of the lesions. The treatment factors are given and briefly discussed. It is pointed out that treatment must be individualized, although the amount of radiation delivered to the cervix proper was about the same in all instances. There were not enough patients in the groups of extreme ranges of dosage to indicate a definite minimum or maximum dose, but the tendency to increased percentage of successes with higher dose may be taken to indicate some dependence of result upon the amount of treatment given.

Three biological characteristics were studied. They were the histopathologic grade of the tumor, the growth type, and the age of the patient. The authors found no significant advantage which may be attributed to lesions of low grade malignancy over more embryonal histopathologic types. Likewise, the growth characteristic could not be made to account for the tendency toward improved results with lower dosage in early cases. There was no significant variation in percentage of successful treatments when results were tested in the group by decades. It was difficult to explain why younger patients may not tolerate intense treatment as well as would be expected.

An analysis of the relationship of complications to treatment showed that these are not more prevalent in patients with more advanced disease, as would be expected. There was no significant difference between the success and failure groups having irritative phenomena or infections. There was questionable increase in the incidence of fistulae and inflammatory reactions in the failure group.

The authors conclude that, as far as prognosis is concerned, the stage of the disease or the actual volume of the tumor is obviously the most important

factor. Of the other biological characteristics, the growth type seems important. The age of the patient is of less importance, although menopausal women do not fare as well as women in the older age group. They also suggest that the results in the treatment of carcinoma of the uterine cervix would be improved by varying the amount of treatment according to the gross extent of the disease.—*R. D. Moreton, M.D.*

Czech, Horst. Die intrauterine Radiumbestrahlung des Gebärmutterkörperkarzinom an der Universitäts-Frauenklinik Göttingen. (Intrauterine radium therapy of carcinoma of the uterine corpus in the Gynecologic Clinic at the University of Göttingen.) *Strahlentherapie*, 1951, *84*, 524–539.

Measurements of spatial distribution of radiation in wax phantoms demonstrated that packing the uterus with a number (9–20) of small, cylindrical containers of radium yielded more favorable results than use of a single larger cylindrical container. Particularly in large uterine cavities, the single rod-shaped container would fail to deliver a curative dose of radiation to carcinoma in the fundus.

A dose of 7,500 r was set as the maximum to the external surface of the uterus anteriorly and posteriorly because of the proximity of the urinary bladder and the rectum at these critical points. On this basis, and from the above spatial distribution of dosage in the wax phantoms as varied by the size of the uterine cavity, three applications of 1,800–2,300 mg. hr. each were established to be necessary to deliver such a maximum dose to these critical areas.

Illustrations and tables set forth the details of the method preferred at the University of Göttingen Gynecologic Clinic and dosage distribution for several different methods of radium application in the uterine cavity.—*H. G. Moehring, M.D.*

Merren, David D., Vest, Samuel A., and Lupton, Charles H. Treatment of malignant tumors of the testis. *J. Urol.*, Jan., 1951, *65*, 128–135.

The authors review a series of cases of malignant tumors of the testis in an attempt to evaluate the efficacy of various treatment methods. The authors treated 41 cases with simple orchiectomy and in most cases postoperative irradiation. Their survival rate in embryonal carcinomas, exclusive of chorionepitheliomas, was 53 per cent in a series of 15 cases. They compare this result with figures published by Lewis for a series of comparable tumors treated with orchiectomy, radical dissection of the regional lymph nodes and postoperative irradiation. Lewis, in a series of 45 comparable cases, had a survival rate of 33 per cent.

The authors consider the two series comparable because the classification of Friedman and Moore was employed in each. They conclude that the necessity for radical lymph node dissection in embryonal carcinomas has not been proved. The cases of Lewis, in addition, were treated with million volt therapy in contrast to the authors' cases, who were treated by 200,000 volt therapy.—*R. M. Harvey, M.D.*

RADIOISOTOPES

Waser, P., and Hunzinger, W. Bestimmung von Kreislaufgrössen mit radioaktiven Substanzen (Radiocirculographie). (Determination of the circulatory volume with radioactive substances [radiocirculography].) *Schweiz. med. Wchnschr.*, March 3, 1951 *81*, 216–221.

Some of the hemodynamics of human circulation can be simply and safely studied with the aid of radioactive sodium. The authors inject 0.2–0.3 mc. of Na^{24} into the arm vein of the subject and record the appearance of the radioactive "tagged" blood at various points in the body by means of Geiger-Müller tubes recording simultaneously on a film strip. A double Geiger-Müller tube the axis of which lies in the direction of the ventricular septum allows the separate registration of "right heart" and "left heart" curves. The initial or right heart curve follows the arm vein injection and is higher and more distinct than the left heart curve which begins after the end of the right heart curve, following the return of the tagged blood from the lesser circulation. Measurements of intervals between the curves and the amplitude and duration of the curves were made on 600 patients. Some cardiac diseases produce certain characteristic changes in the pattern of the curves which may be used as an adjunct to diagnosis. The circulation time, the lung time (when the radioactive material is in the lesser circulation), and the left heart time (when the tagged blood is in the left ventricle, before it enters the arteries), are all intervals which may be altered by disease. Changes in these intervals can indicate the efficacy of therapy in serial studies.

Direct injection of the radioactive substance into a peripheral artery with measurement of radioactivity along the course of the vessel aids in the determination of vessel obstruction.

Of interest is the authors' mention of their recent investigation of the use of a radioactive isotope (I^{131}) adsorbed to a high polymer carbohydrate which when injected cannot pass the lung capillaries, a generalized lung irradiation, of possible therapeutic usefulness, resulting.—*Harold Fulton, M.D.*

Oeser, H., and Billion, H. Untersuchungen mit etikettiertem Biliselektan. (Investigations with tagged biliselectan.) *Fortschr. a. d. Geb. d. Röntgenstrahlen ver. m. Röntgenpraxis*, Feb., 1951, *74*, 197–203.

The authors report their experiences with a labeled or tagged gallbladder opaque medium—a combination of biliselectan (priodax) with radioactive iodine (I^{131}). The examination was carried out on 10 healthy persons with the idea of shedding some light on the excretory function of the liver and concentrating function of the gallbladder.

The prepared material contains 3 to 6 grams of biliselectan in capsule form or 3 grams in the powdered or tablet form. A dose of I^{131} consisted of 100 microcuries. Mapping of the liver and gallbladder areas was done and curves of intensity of radiation over the gallbladder area were prepared as well as a study of the urine output. The results are shown graphically by tracings and the activity standards are summarized. The tracings are influenced by the intestinal absorption of the biliselectan and by its elimination through the kidneys and liver as well as by the capacity of the gallbladder. Cholecystography is carried out with this new substance in terms of the combined roentgen examination and fractionated activity.

The method could be used to explain the reasons for poor cholecystographic results. The gallbladder activity measurements will indicate the moment of best opaque filling and the gallbladder tracing will apparently provide some better information as to the evacuation of the gallbladder rather than relying on the roentgenogram alone. The radioactive material may also prove to have a therapeutic purpose in having spot radiation for certain disease conditions of the liver and gallbladder, but this apparently is for future consideration.—*P. C. Swenson, M.D.*

Dixon, F. J., Bukantz, S. C., and Dammin, G. J. The effect of sensitization and x-radiation on the metabolism of I^{131} labeled proteins. *Science*, March 9, 1951, *113*, 274–276.

A brief historical introduction is followed by a list of reasons why an I^{131} label on proteins is desirable; they are:

1. I^{131} can be attached to proteins without measurably altering immunologic specificity.
2. A stable chemical linkage is formed.
3. Release of liberated I^{131} can be accomplished by iodine pre-feeding to saturate the iodine utilizing tissues.
4. Liberated I^{131} is not organically incorporated into the animals' body proteins.

Labeled proteins were given intravenously. Rabbit homologous globulin (RGG) established a base line blood elimination curve. Bovine gamma globulin (BGG) in normal rabbits served as a control. Behavior was similar to RGG for four days, after which, just prior to appearance of circulating antibody, elimination became more rapid. On the ninth day less than 0.1 per cent was present in the entire blood volume. BGG in rabbits immunized twenty days earlier had most rapid excretion. BGG in rabbits forty-eight hours after exposure to 500–600 r of 200 kv. roentgen rays demonstrated an interference with the development of an immune state. The rate of elimination resembled that of RGG for about seven days, and then slowly increased. Circulating antibody was found in only a few of the irradiated animals fourteen days after injection. BGG coupled with diazotized p-amino benzoic acid (P-AP) in normal rabbits gave most rapid excretion from the blood.

Urine excretion reflected rate of elimination from blood except for P-AP where urine levels were low due to tissue retention. I^{131} appeared as iodide or in organic, but not protein, combination. This indicated catabolism of originally labeled protein.

Tissues had no selective uptake or retention of BGG. Levels never exceeded those of blood except in fatal anaphylaxis, in which case blood loss was rapid, and accumulation in the lung intravascular masses occasionally surpassed eight times the blood concentration.

The data support the view that I^{131} labeled proteins are handled like those proteins in which the radioactive label is more intimately incorporated in its molecular structure, as with C^{14} and N^{15}.—*Z. S. Gierlach, M.D.*

Masouredis, S. P., Low-Beer, B. V. A., Bierman, H. R., Cherney, L. S., and Shimkin, M. B. The partition of radiophosphorus (P^{32}) in blood, urine, and tumor tissue in patients with Hodgkin's disease and lymphosarcoma before and after treatment with nitrogen mustard (methyl bis [beta-chloroethyl] amine). *J. Nat. Cancer Inst.*, Oct., 1950, *11*, 289–300.

This report is based on the results obtained in 6 patients, 4 having Hodgkin's disease and 2 having lymphosarcoma. Tracer doses of approximately 300 microcuries of radioactive phosphorus were given to each patient before nitrogen mustard therapy and repeated one hour after HN_2 therapy.

Surface counting with a lead shielded Geiger-Müller end window counting tube was done over the superficial nodes in the neck. Normal control tissues were also surveyed. All counts were greater than ten times background. The radioactivity of plasma and urine was determined at frequent intervals during the study.

In 3 patients, 2 having Hodgkin's disease and the other lymphosarcoma, the response to therapy was poor, while in the remaining 3 patients the response was good. In those patients showing a poor response, the pre- and post-mustard tumor uptake curves as measured by surface counting were identical as were the curves of the normal control tissues. Urine excretions and plasma concentration levels were also identical. However, in those patients showing a good re-

sponse to therapy, the tumor uptake curves, as well as the normal tissue curves, were significantly altered after HN_2 therapy. The over-all rate of appearance of radiophosphorus in the tumor tissue was reduced by a factor of from 1/10 to 1/5 of the pre-treatment rate. In these patients the rate of urine excretion of P^{32} was also greatly increased when compared to the pre-treatment rate of excretion.

The concentration time relationship of radiophosphorus in plasma in all 6 patients was identical before and after therapy.

In 1 untreated patient with lymphosarcoma a lymph node biopsy was obtained at the time of maximum tissue activity (18 minutes) to determine what fraction of tissue activity is intracellular. Practically all of the radiophosphorus was found in the acid soluble fraction and it was found that 70 per cent of this fraction was intracellular.

Because of the alteration in the tumor uptake rate as well as in the normal tissue uptake rate in patients showing a good response to therapy, the authors conclude that the response to HN_2 is possibly related to some generalized effect upon the organism rather than being a specific effect upon the neoplastic tissue.—*J. P. Storaasli, M.D.*

Wiseman, Bruce K., Rohn, Robert J., Bouroncle, Bertha A., and Myers, William G. The treatment of polycythemia vera with radioactive phosphorus. *Ann. Int. Med.*, Feb., 1951, *34*, 311–330.

The authors report on 108 cases of polycythemia vera treated with radioactive phosphorus, and an additional 30 cases treated by conventional methods. In this disease a panmyelosis is characteristic. The primary process may be a reticuloendotheliosis.

The therapeutic objective is one of controlling the excessive hyperplasia of all the marrow elements with minimal danger, discomfort, and expense to the patient. Disadvantages of the conventional methods of treatment are listed. Radiophosphorus not only meets the hematological and clinical requirements but the freedom from discomfort and comparative low cost make the patient more cooperative. Individual sensitivity to irradiation varies, and each case must be considered in terms of effects on each of the circulating blood elements.

Symptoms of fatigability, headache, vertigo, and bone pain responded successfully to radiophosphate. Pruritus was the most resistant symptom, with about 17 per cent failures.

Physical signs, such as color of skin, conjunctival injection, purpura, and petechiae, splenomegaly and hepatomegaly, showed practically complete reversal.

Case reports of 7 patients are presented graphically and discussed. These clearly show the individual response—variation to P^{32} irradiation. Satisfactory results with 3.5 millicuries of P^{32} are usually obtained. It is cautioned that a change in the total red blood cells should not be expected before two months. Repeated small doses (about 1.0 mc.) may be inadequate to obtain suppressive effects on bone marrow.

An analysis of the causes of death in 453 cases treated with P^{32} reported in the literature is tabulated. Of these, 40 are known dead, and the cause of death has been determined. About one-third died of an acute leukemia, but none of chronic leukemia. The total number of deaths from leukemia of all types is less in those treated with P^{32} than in other groups. It is probable that a small number of cases of chronic leukemia have been converted into the acute phase.

The following standardized procedure is presented:

A Standardized Method of Treatment of Polycythemia Vera with P^{32}

1. If red blood cell count exceeds 7.5 million:
   Venesection of 1,000 cc./48 hr. to 6.0 million.
2. Initial dose of P^{32} (25 per cent less for parenteral administration):
   Initial R.B.C. over 9.0 million—4.5 mc., National Bureau of Standards Strength.
   Initial R.B.C. over 8.0–9.0 million—4.0 mc., National Bureau of Standards Strength.
   Initial R.B.C. over 7.0–8.0 million—3.5 mc., National Bureau of Standards Strength.
   Initial R.B.C. under 7.0 million—3.0 mc., National Bureau of Standards Strength.
   Give 1 mc. less than this schedule if platelet level is not elevated.
3. For oral administration:
   No food for 6 hr. prior to P^{32} treatment.
   No food for 3 hr. after P^{32} treatment. Encourage water ad lib.
   Discontinue Fe or PO_4 medication 24 hr. before and after P^{32} treatment. No soft drinks.
   No P^{32} given orally if frequent stools are present.
4. Blood checked monthly for red blood cell count, white blood cell count, and platelets.
5. Additional P^{32} not given at intervals of less than 2 months.
6. Amount and frequency of retreatment judged by response to first dose.
7. No P^{32} given if blood platelets $<150{,}000$ (indirect method), reticulocytes >0.2 per cent, white blood cells $<3{,}000$.
8. Adequate protection of personnel necessary.—*Z. S. Gierlach, M.D.*

Sturgis, Somers H., DeMuylder, Edgard, and Meigs, Joe V. The uptake of labelled phosphorous by cancer of the cervix; preliminary report. *Ann. Surg.*, March, 1951, *133*, 305–312.

It was the purpose of this study to determine if radiophosphorus might be of value in problems related to cancer of the cervix. The patients were

given 3.7 microcuries per kg. of P^{32} intravenously about forty-eight hours before 25–50 mg. cervical specimens were obtained.

Originally controls were taken from areas of unaffected cervix, but as few patients showed sufficient uninvolved cervix this method had to be discarded. Three cancer patients in this category showed cancer to normal P^{32} count ratios of three times in the lowest to ten times in the highest.

The factors involved in seeking a more suitable approach, such as body weight, hematocrit, extracellular fluid, nutrition, etc., are discussed.

It was found that a reliable ratio of counts between whole blood and serum existed forty-eight hours after injection, despite wide dosage fluctuation (200–2,000 microcuries). Thereafter results were recorded as ratios between 1 gram of tissue and 1 cc. of forty-eight hour serum. In 28 cervical specimens significantly higher ratios were found in 13 cases of invasive epidermoid carcinoma; 4 normals gave low ratios, while cancer in situ gave ratios between the other two groups. Benign repair processes were not associated with increased P^{32} ratios. Correcting the above data for the dose per kilogram gave essentially the same results.

It is stressed that there is possibility of error in emphasizing a specific figure obtained from one or several 25 mg. biopsies from a large mass of tissue, with considerable histopathologic variation. Further work is in progress to estimate rate of turnover so that specific activity studies can be made.—*Z. S. Gierlach, M.D.*

COONEY, JAMES P. The physician's problem in atomic warfare. *J.A.M.A.*, March 3, 1951, *145*, 634–637.

Today's international situation has imposed a heavy responsibility on the American physician with the possibility of atomic bombing of our cities. A brief discussion of the hazards that might be encountered are given to supply the physician with data obtained from Japan, Bikini and Eniwetok.

Casualties are due to: (1) "Blast" consisting of direct blast effect caused by sudden increase of pressure and indirect blast effects caused by flying debris, timbers and glass. (2) Thermal burns consist of flame and flash burns sustained by results of secondary fires and from the intense heat radiated from the "ball of fire." (3) Radioactivity causes injury to tissues by ionizing radiation. The various types of ionizing radiations differ in their ability to cause ionization and include the alpha particle, beta radiation, gamma ray and neutrons. The last two are essentially external hazards but alpha particles and beta radiations may be internal hazards.

In an air burst there is both direct and indirect blast effect. The flame burns depend upor the type of construction of the city and the efficiency of the fire fighters; the flash burns are the result of an enormous pulse of infra-red radiation, visible light and ultraviolet rays. Flash burning of exposed skin was observed over a distance of $2\frac{1}{2}$ miles in Japan with serious disabling burns encountered as far as $1\frac{1}{2}$ miles. The effect of flash heat energy occurs during the first three seconds following the detonation. The factors influencing burn casualties depend on the season of the year, the amount of clothes worn, time of day with approaching darkness and during rush hours with more persons in the open than otherwise. Fog, haze and rain greatly reduce the radius of flash heat effects.

Radioactivity consists of prompt and delayed radiation. Prompt radiation comes from the chain reaction itself and lasts only a few millionths of a second and consists of gamma rays and neutrons. Delayed radiations are composed of gamma rays and beta particles from fission products. Nearly all the fission products are in and around the "ball of fire" and after about $1\frac{1}{2}$ minutes the fission products in the cloud are so far away that their gamma rays are no longer effective. Within two minutes after an air burst, such as occurred in Nagasaki and Hiroshima, effective radioactivity drops to virtually zero and it is perfectly safe to enter the bombed area to begin evacuation and control fires. Residual radiation is emitted from fission products falling from the cloud and becomes of paramount importance in a ground or underwater burst.

Induced radiation will be present after an air burst but will not be sufficient to be a significant biologic hazard.

In a ground burst the area of blast damage will be decreased and the burn and initial ionizing radiation hazard will be decreased. The residual ionizing radiation hazard will be increased. In the ground burst the beta particle becomes more important in that it can cause local destruction of the skin. Clothing, shoes and gloves should be worn to prevent beta-emitting material from coming in contact with the skin. Internal radiation is also a problem. Packaged or canned food will be fit for consumption but unprotected food in a contaminated area must be examined by a radiation detection instrument before use. Water in a contaminated area should be checked before use. The amount of radioactive material required to contaminate the water supply of a large city is so great that this hazard seems extremely unlikely.

In an underwater burst thermal flash burns will not occur and initial radiation casualties will be greatly decreased. Residual radiation casualties, however, will be greatly increased, provided the phenomenon of the "basesurge" can be produced. Thus an underwater blast presents primarily a radiation hazard.

The author refers those who wish more information to the Handbook on Atomic Weapons published by the Atomic Energy Commission and the Department of Defense.—*J. H. Gilmore, M.D.*

Dixon, W. R., Fish, F., and Morrison, A. Preliminary depth dose and isodose measurements for cobalt-60 teletherapy unit. *J. Canad. A. Radiologists*, March, 1951, *2*, 12–13.

The authors present their preliminary measurements for a trial source of cobalt-60 delivering 0.7 r/min. at 1 meter. Collimation of the beam was achieved by lead diaphragms. Two methods of measurements were used: small integrating ionization chambers made by the Baldwin Instrument Company, and roentgenographic films, with relative intensities being calculated from a characteristic curve of density versus exposure obtained for film exposed in the masonite phantom.

Depth dose and isodose measurements were made for source phantom distance of 125 cm. and two field sizes, *i.e.*, 6 by 6 and 11 by 13 cm. The maximum dose occurs at a depth of 3 to 5 mm. inside the phantom. This depth corresponds to the average range of the Compton electrons generated by gamma rays of energies of order of 1.16 and 1.32 mev.

At a depth of 10 cm. the 11 by 13 cm. field yields a dose of 59 per cent, and the 6 by 6 cm. field a dose of 56 per cent. A 50 per cent dose is achieved at a depth of 12.6 cm. for the larger field and at 11.6 cm. for the smaller field.

It is believed, from these preliminary measurements, that the dosage distribution obtained from a cobalt-60 teletherapy source is suitable for efficient treatment of deep-seated tumors.—*I. R. Berger, M.D.*

Carroll, Walter W., Biddle, Arthur S., and Cooper, John A. D. Use of radioactive tracer material in the differential diagnosis of experimental jaundice. *Quart. Bull., Northwestern Univ. M. School*, Spring, 1951, *25*, 13–18.

In order to aid in the differential diagnosis of clinical jaundice the authors have investigated the radioiosotope tracer technique applied to experimental animals utilizing the metabolism of a dye which has been shown to be excreted at least in part by the liver. Tetraiodophenolphthalein was used and "tagged" with radioactive iodine by chemical synthesis.

The dosage finally arrived at, after considering the quantity of the drug and the amount of the radioactivity, was 0.5 grams of tetraiodophenolphthalein with an administered activity of 20 microcuries per kilogram.

Three groups of animals were used: one serving as control, another with obstruction of the common bile duct by ligature done two and nine days previously, and a third in which acute liver damage had been inflicted by chloroform intoxication.

Blood levels, renal excretion and fecal analysis were checked and are listed by graphs in the article.

The authors conclude that following intravenous administration of radioactive tetraiodophenolphthalein predictable blood and urinary dye levels can be obtained in a normal dog. Characteristic blood curves representing the dye levels vary extensively with dye dosage and 0.5 gm. of tetraiodophenolphthalein is a practical dose to detect the variations existing between normal and jaundiced dogs. When a dog's common bile duct is obstructed by ligature, alterations in blood and urinary dye level curves are found which are characteristic. When liver suffers acute cellular necrosis the resultant jaundice can be differentiated from that due to common duct obstruction by predictable alterations in the same dye levels. Analysis of renal excretion data during the first twelve hours of this test serves to further differentiate between the normal and jaundiced dogs. The quantitative fecal analysis serves to differentiate the common duct obstructed dog from the normal and one with acute hepatiocellular necrosis.—*J. H. Gilmore, M.D.*

Kriss, Joseph P. Uptake of radioactive iodine after intravenous administration of tracer doses. *J. Clin. Endocrinol.*, March, 1951, *11*, 289–297.

A test dose of 40 to 100 microcuries administered intravenously is used in an attempt to evaluate the degree of thyroid hyperactivity. Readings with a shielded Geiger counter 10 cm. from the thyroid region are made at one hour after administration. A comparison of the results in euthyroid subjects and patients with various thyroid states shows that the uptake value at one hour after administration of the tracer has been found to differentiate satisfactorily between the euthyroid and hyperthyroid states and exhibits excellent correlation with the degree of clinical toxicity. In some normal patients it is more reliable than the basal metabolic rate which may be disturbed by lack of cooperation during the test. The one hour method also offers advantages over the twenty-four hour oral method in rapidity and in diagnostic accuracy by reducing the overlap in values between normal and hyperthyroid subjects.—*R. P. Barden, M.D.*

Foote, J. B., and Maclagan, N. F. The thigh-neck clearance; a simplified radio-active test of thyroid function. *Lancet*, April 21, 1951, *1*, 868–871.

This test is based on a clearance factor which is the increase of neck counts in one hour (high count minus low count), divided by the maximum thigh count within that hour. In two experimental groups, plasma radioactivity and thigh counts at one and two hours showed good correlation.

Three days before the test the patient is advised not to eat fish, iodized salt, natural goitrogen-containing foods, and to abstain from iodine-con-

taining drugs and prescribed goitrogens. Having fasted for five hours, the patient is given orally 30 microcuries of I^{131} with 20 micrograms of KI in 50 ml. of water.

After ten minutes a shielded, fixed-geometry apparatus is fitted over both the neck and thigh. Counts are taken alternately (3 one minute neck counts; 1 ten minute thigh count) until the maximum thigh count has been passed. This is usually within one hour. The data are plotted as "counts per minute" versus "minutes after dose," after which clearance is calculated.

One hundred patients were studied, including 24 normal volunteers. The normals gave a mean thigh-neck clearance of 3.5, with a range of 1–9 units. In 14 cases of thyrotoxicosis the range was between 21 and 100 units, while 17 non-toxic goiters gave essentially control values. Well below normal clearance values were obtained in 8 cases of myxedema. Eight patients on antithyroid therapy, except for three days prior to the test, gave high values. This may be due to incomplete control, or to the withdrawal effect. After iodide ingestion, 3 patients gave lowered clearance. Normal values were found in a miscellaneous group, including obesity, anorexia nervosa, Simmonds' disease, neurosis, etc.

Plasma iodide clearance data from the literature compared favorably with the thigh-neck clearance. Periodic venipuncture is obviated. This test is better for the diagnosis of myxedema than the neck-thigh ratio.—*Z. S. Gierlach, M.D.*

KOLETSKY, SIMON, and CHRISTIE, JAMES H. Biologic effects of radioactive phosphorus poisoning in rats. *Am. J. Path.*, March-April, 1951, *27*, 175–207.

In this paper the authors summarize their studies of the biologic and morphologic effects of lethal radioactive phosphorus poisoning in rats. The types of lesions, their progressive development, the effects on the organism as a whole, the reversibility or irreversibility, and some of the factors involved in producing death are discussed.

Radioactive phosphorus, because of its predilection to bone, acts as a powerful hemopoietic poison, producing aplasia of the bone marrow and hypoplasia of the lymphoid tissues of the body. This was reflected in the circulating blood by severe and rapidly developing leukopenia, thrombocytopenia and anemia. The gonads and intestinal tract were also found to be sensitive to the radiation from P^{32}. Organs such as the liver, pancreas, adrenals, kidneys, heart and brain were resistant to the radiation. Tissue destruction occurred early. Within six to twelve hours after the parenteral administration of radioactive phosphorus, cell destruction was noted and the principal mode of destruction was by karyorrhexis. By twenty-four hours, involution of the hemopoietic organs was marked and progressed over the next several days.

The general condition of the animals was good during the period of necrosis and involution. This latent period was then followed by progressive inanition, debility and weight loss, terminating in death within three weeks after administration of a lethal dose of radioactive phosphorus. At the time of death, aplasia of the bone marrow, atrophy of lymphoid tissues and persistent leukopenia were present. The hemopoietic system often showed some regeneration and the intestinal damage was largely repaired.

Those animals which recovered from the usually lethal dosage of P^{32} showed good repair of bone marrow and lymph nodes within a few months. Regeneration was less effective in spleen and thymus, and in the testis regeneration was from slight to negligible.

It is acknowledged that the mechanism of radiation death is still obscure. A discussion is made of the effects of generalized toxemia resulting from extensive tissue destruction in those animals which received large doses of radioactive phosphorus and died, within days. Those animals which lived, for a longer period of time, but eventually died, experienced the effect of severe bacterial toxemia which undoubtedly contributed considerably toward their death.—*J. P. Storaasli, M.D.*

HAHN, P. F., CAROTHERS, E. L., DARBY, W. J., MARTIN, M., SHEPPARD, C. W., CANNON, R. O., BEAM, A. S., DENSEN, P. M., PETERSON, J. C., and MCCLELLAN, G. S. Iron metabolism in human pregnancy as studied with the radioactive isotope, Fe^{59}. *Am. J. Obst. & Gynec.*, March, 1951, *61*, 477–486.

The authors have analyzed various factors influencing the absorption of iron by giving tagged single doses to 466 pregnant women. It was demonstrated that iron uptake was related to dosage level and period of gestation. At given dosage levels the radioiron percentage uptake increased as gestation progressed from the tenth or fifteenth up to the thirtieth or thirty-fifth week. Specifically the percentage uptake was greatest with doses of 9 mg. or less. However, the actual quantity of iron taken up increased from the lowest to the highest doses. Before the twentieth week of gestation, the percentage uptake was significantly higher in the higher parity groups.

Approximately 2–3 per cent of the iron ingested by pregnant women crossed the placenta to the fetus. According to the authors, the percentage uptake by the fetus decreased as gestation progressed. The quantity of iron taken up by the fetus was relatively greater in early fetal life.

No relation was demonstrated between the hemoglobin level and the radioiron uptake. The authors feel that this is due to the fact that the patients

examined were non-anemic. They expect one would find a relationship if the patients had hypochromic anemia.—*K. R. Kaess, M.D.*

Osgood, Edwin E. Titrated, regularly spaced radioactive phosphorus or spray roentgen therapy of leukemias. *Arch. Int. Med.*, March, 1951, *87*, 329–348.

The author has reported his experience with "titrated," regularly spaced total body irradiation by either radioactive phosphorus or roentgen therapy in the treatment of chronic leukemia. The report is based on 58 cases—20 of the chronic granulocytic and 38 of the chronic lymphocytic type. Based on the principle that the radiobiological action on normal or leukemic cells is to decrease the rate of cell division, he feels that any selective effect is due to the latter's shorter life span and shorter intermitotic interval. Thus, one should stop using massive doses of radiation since one could not hope to destroy all leukemic cells. The therapist should "titrate" the radiation to obtain for the patient the best clinical result.

Immediate radiation therapy without delay to await the onset of symptoms is advocated. Utilizing either spray roentgen therapy or radioactive phosphorus, large doses at short intervals were administered for an initial control period. Certain advantages of P^{32} therapy over total body roentgen irradiation were noted. These are selective localization in the involved leukemic cells; the option of giving a larger dose in terms of rems without radiation sickness; and, greater time intervals between treatments.

The author states that 80 per cent of the survival time of leukemic patients was spent in normal living. He agrees with Leucutia's previous review that prolongation of average life duration is probably insignificant.—*K. R. Kaess, M.D.*

CHEMOTHERAPY

Stock, Francis E. Nitrogen mustard and urethane in the treatment of nasopharyngeal carcinoma. *Lancet*, March 17, 1951, *1*, 612–613.

The author, a resident of Hong Kong, states that nasopharyngeal carcinoma is the most common type of carcinoma seen in Hong Kong and South China. It shows a wide age incidence and in the series reported the average age was thirty-seven years.

Treatment by surgery and radiation therapy is extremely unsatisfactory. The author describes the results of treatment with nitrogen mustard in a series of 25 cases and with urethane in a series of 23 cases.

Nitrogen Mustard. The 25 cases were unselected and included all the late stages of nasopharyngeal carcinoma. In all patients metastatic lymph nodes were present and were usually biopsied before and again at the end of the treatment. In a few instances there was a very slight diminution in the size of the enlarged lymph nodes and in advanced lesions with bone involvement there was a temporary decrease in the amount of pain, but in no instance did the relief last more than four weeks and in most cases there was no effect upon the tumor mass and no relief of symptoms. Biopsies before and after treatment showed no changes of significance.

Urethane. In this series 23 patients with advanced nasopharyngeal carcinoma were regarded as beyond hope and high and potentially dangerous doses of the toxic drug were considered justifiable. Of the patients so treated, 5 showed great improvement, 4 showed slight improvement, 4 showed no improvement, 5 refused adequate treatment, and 5 died in the hospital. "Great improvement" means disappearance of the primary or secondary mass or both. "Slight improvement" means diminution in size of the mass and increased mobility.

The author feels that although the follow-up period is short the initial results are significant inasmuch as this tumor does not regress spontaneously.

Some of the cases undergoing complete regression already show signs of recurrence and therefore it is suggested that a combination of urethane and radiation therapy may result in more permanent relief.

The effect of urethane on the white blood cell count is variable. Usually there is an initial rise to about 12,000 cells per cu. mm. followed by a slow fall and when a patient receives two courses of urethane therapy the white blood cell count may fall on the first occasion, recover in the interval and not fall during the second course.

The author concludes that the effect of urethane on nasopharyngeal carcinoma is only temporary and that whenever benefit has been noted the growth has recurred fairly rapidly.—*W. W. Maver, M.D.*

Miller, Norman F., Thompson, George, and Johnson, Walter. Of what value is the male hormone in the management of genital cancer in the female? *Am. J. Obst. & Gynec.*, March, 1951, *61*, 582–588.

The authors report the findings of a planned three year study on the value of male hormone in the management of genital cancer in the female. Previously untreated patients with genital cancer were given customary radiation therapy and, in addition, male hormone as adjuvant medication. A total of 91 women with genital carcinoma were incuded in the study.

The technique of the radiation therapy and the dosage of the supplemental hormone medication are described. The results are discussed and well illustrated with charts.

On the basis of their three year study, the authors were unable to demonstrate any life prolonging or growth delaying effect in carcinoma of the cervix or

endometrium by the supplemental use of male hormone therapy.—*R. D. Moreton, M.D.*

COSTA, V. Castration et hormonothérapie androgène dans le cancer primitif du sein de la femme et dans ses métastases. (Castration and androgen hormonal therapy in primary cancer of the female breast and in its metastases.) *Gynéc. et obst.*, 1951, *50*, 125–158.

After a concise historical review of the treatment of breast cancer in the female by ovariectomy, radiation castration, and testosterone therapy, the author reports on the effect of ovariectomy and testosterone therapy on 22 women who had radical mastectomies for cancer.

In one group of 15 cases, the treatment was given for symptomatic relief of metastases, with a favorable effect in 8 and no effect in 7. The favorable palliative effects were largely subjective, with relief of pain and improvement in the state of well-being, but in some cases there was healing of bone metastases, including a spontaneous fracture of the femur, clearly illustrated by roentgenograms.

In the second group comprising 7 cases, ovariectomy was performed at about the time of the radical mastectomy, as a prophylactic measure, and in 2 cases testosterone therapy was also administered. The author is of the opinion that 2 patients who had unfavorable clinical histories were benefited by prophylactic ovariectomy because they have survived one and a half to two years without evidence of disease.

It was noted that testosterone therapy given to a dose of 3 grams in three weeks not only caused hirsutism, increase of libido, and anxiety, but also occasionally produced painful polyarthritis which could be confused with metastases. The fibroblastic tissue reaction apparently produced by testosterone may be a factor in its mode of action which is otherwise obscure.—*S. M. Silverstone, M.D.*

BROHÉE, GEORGES. ACTH, cortisone ou salicylate de soude et maladie de Crohn. Thérapeutique d'essai. (ACTH, cortisone or sodium salicylate in Crohn's disease; therapeutic trial.) *Acta gastro-enterol. belg.*, Jan., 1951, *14*, 39–45.

Crohn's disease is thought to have an allergic component but the allergen is unknown. ACTH and cortisone have been used in treatment. The author considers the possible use of sodium salicylate with or without calcium pantothenate, in the acute and subacute forms of the disease when the allergic reaction is thought to be most prominent. The basis for this therapy is the finding by Schwartzmann *et al.* in 1950 that the Schwartzmann phenomenon is inhibited in rabbits by 75 mg. of cortisone, by ACTH in doses six times less and by 1.6 gm./kg. of sodium salicylate, particularly when given in association with 40 cg./kg. of calcium pantothenate. In these doses, ACTH gave the best inhibition, presumably acting through the adrenal cortex. Comparable doses of ACTH and cortisone in man would be dangerous and costly. The optimum therapeutic blood level of salicylic acid would be 50 mg./100 cc. serum requiring 15–20 gm. of sodium salicylate by mouth. As a practical compromise, 5–8 gm. by mouth is suggested, giving blood levels of 18–30 mg. per cent. Appropriate doses of sodium bicarbonate are also given. Some patients tolerate these doses. A possible danger is the appearance of Cushing's syndrome but this is an argument in favor of its trial.—*M. L. Sussman, M.D.*

MISCELLANEOUS

WILSEY, R. B. The use of photographic films for monitoring stray x-rays and gamma rays. *Radiology*, Feb., 1951, *56*, 229–241.

Photographic film has been used extensively to monitor exposures to stray radiation received by personnel. Frequently films are employed in conjunction with pocket ionization meters. The ionization meter records roentgens directly over a wide range of roentgen-ray quality, can be evaluated immediately after exposure, and is best suited to study of single exposure or exposure during one day. Photographic films must first be processed and provide a long-lasting, direct record of exposure. They permit satisfactory integration of the exposure over a period of several weeks, although by themselves they cannot give a measurement of the quantity of radiation. They must be suitably calibrated so that the densities observed on the monitoring films can be evaluated in terms of roentgens.

Ordinarily some films of the same emulsion number as the films worn by the personnel are given a known exposure or series of exposures, expressed in roentgens, to primary radiation. These calibration films are processed with the monitoring films, and film densities are read on a densitometer. The densities of the calibration films can be plotted against the exposure in roentgens, and the densities of the monitoring films can be evaluated in roentgens by reference to this curve.

Principal phases of this study have involved the comparison of the qualities of primary and attendant stray radiations and their relative photographic or ionization effects, in order to select suitable calibrating radiations for various practical situations. A discussion is given of the use of cadmium filters mounted over the film to equalize its effective sensitivity over a wider range of radiation energies. The application of the lead-cross pocket in monitoring both gamma and beta radiations is described briefly. —*A. W. Sommer, M.D.*

Thompson, W. H., Figley, M. M., and Hodges F. J. A roll-film apparatus for rapid serial filming. *Radiology*, Feb., 1951, *56*, 242–247.

A comparatively inexpensive roll-film apparatus for rapid serial filming is described. Roll film, 11 inches wide, is used to obtain 11 inch square roentgenograms at the rate of 1.3, 2, or 4 per minute. The maximum exposure time is 1/30 second when the 4 per second rate is used. The loaded film magazine, which can hold up to 75 feet of film, weighs only 29 pounds and is very easily disconnected from the driving mechanism for transport to the dark room. The lead shielding is fixed in the table top which can be used in either a horizontal or vertical position. The table top is supported by a tubular frame mounted on casters and elevating screw stops. A complete description of the relatively simple drive mechanism is given. This apparatus is readily adaptable to present day roentgenographic equipment.—*M. B. Goodwin, M.D.*

Stevenson, J. J. Horizontal body section radiography. *Brit. J. Radiol.*, June, 1950, *23*, 319–334.

Since the introduction of body section roentgenography in 1930, it has been possible to obtain good vertical sections, but various practical considerations have made horizontal sectioning more difficult. In 1937 Watson first built a device for horizontal body section roentgenography based on the fundamental principle that of the three factors, the tube, the patient, and the film, two should move together with respect to the third.

His apparatus consists of a fixed tube which is angled downward about 30 degrees and directed toward a cassette which is horizontal on a small turntable. The patient is placed sitting on a small platform between the tube and film, as close as possible to the film. During the exposure, the film and the patient are rotated through a full circle, each on its own vertical axis, and both in the same direction.

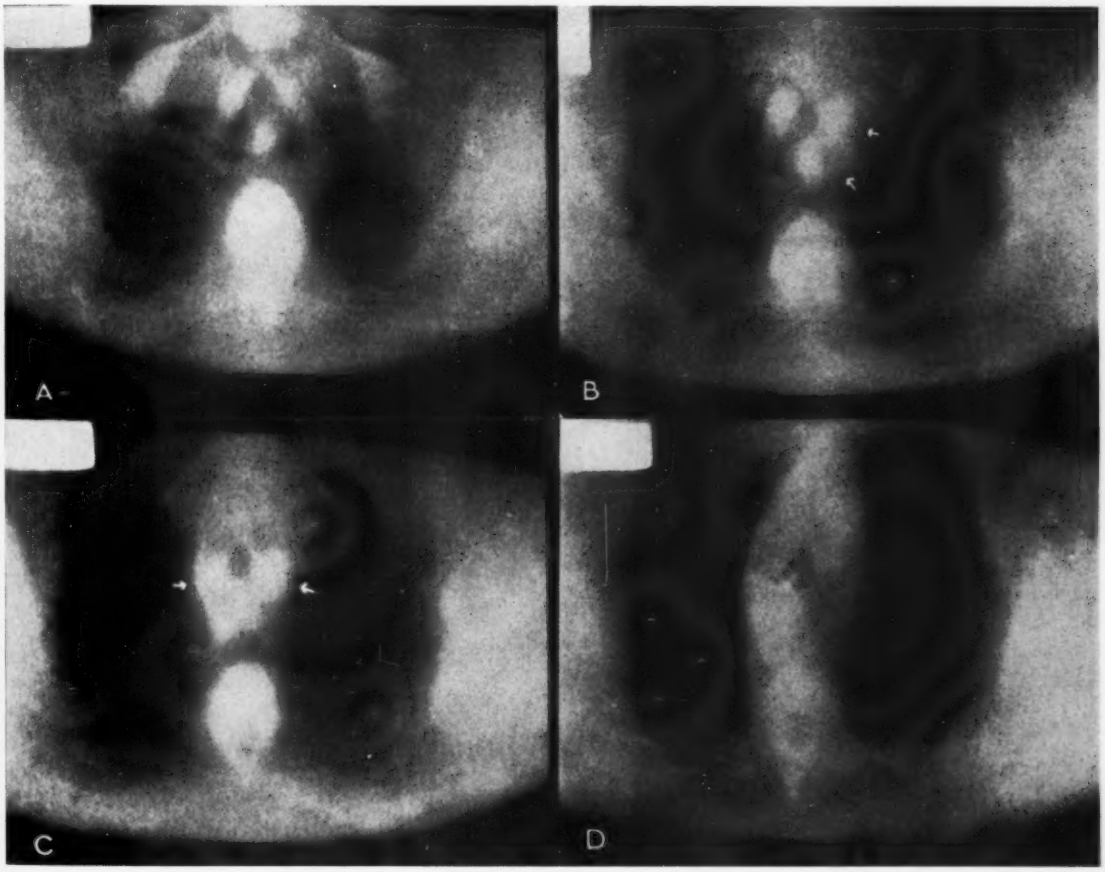

Fig. 1. Double aortic arch. (*A*) Section at the level of the sternoclavicular joints. Normal appearances. (*B*) Section at the level of the higher right-sided portion of the aortic arch. (*C*) Section taken 0.5–1.0 cm. below previous cut. Note the vascular ring comprising the two branches of the aorta which surround the trachea. (*D*) Section taken 0.5–1.0 cm. below previous cut. This only shows the left branch of the aortic arch. Note the opaque tube in the esophagus. (Reproduced by permission from Stevenson, J. J. *Brit. J. Radiol.*, June, 1950, *23*, 319–334.)

Sections between 0.8 mm. and 1.5 mm. are generally obtained. Care must be taken that the axes of rotation are in line with the central ray.

Excellent demonstration of the air passages, aorta, and heart are obtained by this method. Several lesions are shown in a series of excellent illustrations in the original article, among which is a striking demonstration of a double aortic arch (Fig. 1). Both limbs of the aorta are shown as a ring compressing the trachea. Other films display an aortic aneurysm, a right-sided aortic arch with the descending aorta on the right, retrosternal goiter, bronchogenic carcinoma with collapse, and dilatation of the bronchus distal to the obstruction.

A suggestion is made concerning the advantages of this type of study in therapy for simplifying beam direction and calculation of tumor dose.—*E. F. Lang, M.D.*

HOLMAN, COLIN B., and CAMP, JOHN D. Identification of right and left sides in roentgenograms by a permanent cassette marker. *Radiology*, Feb., 1951, *56*, 260–263.

A permanently mounted opaque marker such as the capital letter "F" mounted on the rear surface of the bakelite front of a cassette is described. The "front" surface of an exposed roentgenogram can then be correctly identified. The importance of an asymmetrical opaque marker is emphasized.

The same result can be produced by printing a capital letter "F" in ink on the border of the *back* intensifying screen of the cassette. Likewise, the letter "F" printed backward on the border of the front screen will produce the same desired effect.

This convention enables the radiologist to positively establish the position of the patient irrespective of the technician's film marker.—*E. E. Seedorf, M.D.*

RAAP, GERARD. A position of value in studying the pelvis and its contents. *South. M. J.*, Feb., 1951, *44*, 95–98.

The author describes the Chassard-Lapine position for the pelvis and recommends its use in studying the colon following a barium enema. The patient is placed in the sitting position with the buttocks in the center of the table. The back is flexed and the feet are placed on a stand at the side of the table. The central ray passes through the spine and sacrum. The roentgenographic factors are practically the same as those for the lateral projection of the pelvis.

This positioning has many uses. However, the author finds that it is particularly applicable to studying the colon, giving a more complete visualization of the "blind spot" in the pelvic segment of the colon.—*J. G. Snead, M.D.*

THYGESEN, JORGEN E. Problems of clinical radiobiology. *Radiology*, March, 1951, *56*, 403–408.

The task of clinical radiobiology is divided into the physical and the biological dose problems.

The physical dose is easily measured, but the biological dose is more difficult, since the systemic reaction of the organism represents a change in the general health condition. The limit of total dose is set by the tolerance of the organism as a whole.

The radiation tolerance of an individual is defined as his capacity for homeostatic regulation of oxygen transport. Total hemoglobin and blood volume determinations are advocated before, during and after irradiation. The Sjöstrand carbon monoxide method is described and recommended.

Limited reference is made to the relation of enzymatic activity to radiation injury during cancer therapy.—*E. E. Seedorf, M.D.*

HARVEY, ROGER A., HAAS, LEWIS L., and LAUGHLIN, JOHN S. Preliminary clinical experience with the betatron. *Radiology*, March, 1951, *56*, 394–402.

The authors give a report on the progress, some obstacles encountered and some biological effects observed with the betatron.

The protection of operating personnel with a maximum of 0.3 r per week, and the protection of patients in front of the treatment magnet from scattered rays is described.

Animal experimentation has revealed the biological effectiveness of the measured betatron beam at a maximum of 65 per cent of a corresponding dose roentgen-ray beam.

The depth dose advantages of the betatron are illustrated with isodose charts.

Several case reports demonstrate that the betatron has some deleterious action on certain types of neoplasms, that the depth dose distribution is an advantage for treatment of deep seated lesions, and that the skin reactions are minimal.

The investigators are aiming at complete courses of treatment in a period of four to five weeks, with single daily doses of about 400 betatron r, and totals of at least 5,700 betatron r for pituitary tumors and at least 9,000 betatron r for malignant tumors elsewhere.—*E. E. Seedorf, M.D.*

NEWELL, R. R., and GARNEAU, ROBERT. The threshold visibility of pulmonary shadows. *Radiology*, March, 1951, *56*, 409–415

Using lucite plastic of various thickness and shape, wooden disks and various plant seeds, the authors investigated factors which influence the threshold visibility of pulmonary shadows.

Chest roentgenograms made with lucite particles of various size and shape stuck to the patient's back showed that it requires a piece at least 3 mm. thick to be visualized on the film. When the edges of the plastic were beveled so as to give a fuzzy shadow on the roentgenogram the threshold visibility decreased according to the width of the bevel.

In comparing fuzzy shadows (long bevel) with sharp shadows (square edge) it was found that the viewing distance was important. A given width of bevel appears narrower, the farther it is from the eye because of the narrower visual angle (subtends a smaller visual arc). A fuzzy shadow just at threshold visibility and a square edged shadow will naturally have a different appearance but as the viewing distance is increased, the threshold visible square edged shadow may disappear but the beveled edge shadow will persist. The result of increased viewing distance of threshold shadows is that the retinal image is smaller and therefore the beveled edge shadows persist while the square edged ones disappear.

This probably explains why the fuzzy shadows of tuberculosis can be interpreted so well on miniature films.

A regular repetitive pattern (saw cuts half way through a lucite sheet) increases the visibility of a threshold shadow and if multiple threshold small round shadows are present more will be seen than if only a few are present because the viewer will expect more. Multiple small round threshold shadows will occasionally be superimposed to give added visibility (miliary tubercles are visualized by this summation).

The exposure factors used to produce the roentgenogram are not too important but the higher kilovoltage roentgenograms seemed to improve the threshold visibility slightly.—*C. A. Stevenson, M.D.*

Pape, Rudolf. Biologische Effekte von 1 Jahr lang täglich wiederholten kleinsten Röntgenendosen. (Biologic effects of very small roentgen doses repeated daily for one year.) *Strahlentherapie*, 1951, *84*, 245–254.

The Austrian and German Rules on Radiological Protection specify 0.25 r as the maximum permissible daily dose when the whole body is exposed to roentgen radiation over an indefinite period.

The author experimentally tested the effect of such a dose in 3 rats. One rat was irradiated daily (except Sundays and holidays) for three months, the total dose being 80 times 0.25 r, and the other 2 for one year each, for a total dose of 312 times 0.25 r. The factors were 120 kv., 0.5 mm. Cu, 3 ma., 10 by 15 cm. tube-aperture and a distance of 150 cm. The rats were placed in individual wire cages, so that they could move freely at all times, including the actual roentgen exposure.

The following observations were made:

(1) Daily doses of 0.25 r produce definite biologic alterations when the whole body is exposed over a long period of time. The author, however, does not feel justified in considering these alterations deleterious, at least not on the basis of one a year observation.

(2) An increase in the number of the reticuloendothelial cells and a pronounced stimulation of the lymphopoiesis are noted in the spleen already after three months.

(3) The increased lymphopoiesis is reflected in the circulating blood by a rise of the absolute number of the lymphocytes to two to four times that of normal.

(4) The increased cellular activity occurrs without preliminary cell destruction; in other words, it is possible to stimulate with micro- and inframicrodoses the blood-forming organs without first producing destruction.

(5) The irradiation with very small doses induces increased resistance of the tissues to toxic effect; when carried out as a preliminary procedure, it markedly reduces the deleterious action of the massive doses of from 300 to 600 r.

(6) The increased resistance is often associated histologically with increase in the number of cells of the reticulendothelial system, but the two phenomena, according to the author, must be regarded as concomitant rather than interdependent occurrences.

(7) The aforementioned alterations cannot be considered "inflammatory" in nature, since they are not accompanied by increase of connective tissue in the liver.

(8) The author extended his observations to the spleen, liver and blood-forming organs. Functional alterations are observed, however, also in connection with the endocrine system. Thus in one animal irradiated with 0.25 r for one year the thymus was found to be larger than the thyroid gland.—*T. Leucutia, M.D.*

Montag, Caspar. Über Schädigungen des waschsenden Knochens bei der Röntgennahlbestrahlung und ihre Vermeidung. (On injuries of the growing bone by contact roentgen irradiation and their prevention.) *Strahlentherapie*, 1951, *84*, 314–324.

Baunach demonstrated in experimental animals that a single dose of 250 r produces no deleterious effect on bone but repeated doses of 330 r or a single dose of 800 r lead to permanent developmental disturbances. Although these figures cannot be directly applied to man, numerous reports have appeared in the literature indicating that severe damage to growing bone has been observed. In malignant neoplasms the administration of large doses at an early age often makes such damage unavoidable; in benign lesions, however, its occurrence must be prevented. Of special importance in this respect is the treatment of hemangiomas with roentgen irradiation in children.

During the last decade considerable use has been made of contact therapy with low voltages according to the method of Chaoul and van der Plaats. In this type of irradiation there is a rapid fall of the dose in the layers immediately underneath the skin and therefore the procedure was thought to be particularly suitable for the treatment of such superficial

lesions as the hemangiomas. It was assumed that a deleterious effect on the underlying growing bone could easily be avoided, because of the considerably lesser depth dose as compared to deep roentgen therapy.

A review of the literature indeed shows that cases of bone damage following contact therapy of hemangiomas are now very rare. The author, however, has recently seen 3 patients who were treated since 1942 with the Müller contact apparatus (van der Plaats) for hemangiomas of various locations and in whom several years later a definite retardation of bone growth occurred. The 2 patients are described in detail, photographs, reproduction of roentgenograms and diagrams before and after treatment being used for illustration.

Since the technique of irradiation was available in all 3 instances, the author was able to accurately calculate the dose which reached the damaged bone structures and thus evaluate the threshold below which irradiation may be considered safe. It was determined that a focal dose of 440 r or more administered to growing bone, especially over the epiphyseal lines, results in definite damage with deformities and disturbance or retardation of growth. A dose of 420 r still leads to retardation of growth. On the contrary, focal doses of 275–300 r, even if repeated several times, produce no demonstrable growth disturbances or other alterations.

In conclusion, the author makes certain recommendations to avoid excessive irradiation especially at points of overlapping.—*T. Leucutia, M.D.*

BRZUSTOWICZ, RICHARD J., SVIEN, HENDRIK J., BENNETT, WARREN A., and HIGGINS, GEORGE M. The effect of cortisone on the growth of transplanted ependymomas in mice. *Proc. Staff Meet., Mayo Clin.*, March 28, 1951, *26*, 121–128.

The authors used an ependymoma produced by the implantation of methylcholanthrene into the brain of a C_3H mouse. This tumor was then transplanted subcutaneously into C_3H mice for a number of generations, providing test objects for the study of the effect of cortisone on this tumor. Five series of C_3H male mice were studied.

With dosages of the hormone larger than 0.5 mg. daily, serious toxic effects were induced in the animal as well as marked inhibition of tumor growth. A daily dose of 0.5 mg. ordinarily did not produce toxic effects but did incite definite inhibition in the growth of the tumor as indicated by a decrease in its size and weight.

Total inhibition or complete regression of tumor growth did not occur. Histopathologically, the tumors of animals given 0.5 mg. of cortisone daily showed large areas of necrosis and degeneration, whereas tumors of equivalent age in control animals showed little or no change.—*W. H. Smith, M.D.*

ABESHOUSE, BENJAMIN S. Experimental carcinogenesis and its relation to spontaneous and occupational tumors of the bladder in man. *Urol. & Cutan. Rev.*, Feb., 1951, *55*, 65–78.

This article is a review and detailed historical account of carcinogenesis in particular respect to bladder carcinoma. The author points out that the urological profession should be aware of the importance of certain carcinogenic agents and the mechanism by which they may produce primary bladder tumors. Summarizing the contributions made by British and American investigators during the past twenty-five years, the author notes the following:

(1) Carcinogenic agents possess the common property of damaging or inhibiting the processes of normal growth in a specific manner.

(2) Carcinogens have the ability to produce new cellular variations or a re-orientation of cellular characteristics at a new energy level.

(3) It is theorized that malignant cells may not synthesize certain substances which regulate specific growth factors.

(4) Some carcinogens, such as estrogens, may be tumor producing agents and under specific circumstances possess growth inhibition powers.

(5) The growth inhibitory powers of some carcinogens may be neutralized by specific dietary changes such as vitamin B complexes, and high caloric diet.

(6) Carcinogenesis may be associated with some enzymal disturbance which may lead to the production of new types of cellular proteins with autosynthetic properties.

(7) A study of physiology and cytogenetics of certain unicellular organisms has cast new light upon the mechanism involved in the production of cellular variation. This is illustrated by the role of the gene in the development and transmission of inheritable characteristics.

(8) The role of virus infection in experimental carcinogenesis has been definitely established. There is some evidence that the carcinogenic virus may be identical or closely related to the cytoplasmic gene. —*G. W. Chamberlin, M.D.*

FURTH, J., ANDREWS, G. A., STOREY, R. H., and WISH, LEON. The effect of x-irradiation on erythrogenesis, plasma and cell volumes. *South. M. J.*, Feb., 1951, *44*, 85–91.

The amount of blood required to transfuse adequately the victims of a single atomic bomb explosion is estimated to be more than could be made available promptly by any of the collecting programs now under way. This report on recent research intends to show how the problems of postirradiation anemia are linked to those of capillary permeability and blood clotting disturbances, and emphasizes

the necessity of understanding the immensely complex pathology of the postirradiation state in order to arrive at a rational method for the control of anemia caused by irradiation. The white blood cell counts drop rapidly because white cells have a short life span. Red blood cell counts drop slowly because erythrocytes have a long life span.

The importance of correlating the red cell mass and the plasma volume in determining the degree of anemia is stressed. The routine red cell counts, hematocrits, and hemoglobin readings do not give an adequate evaluation and the cell mass is best determined by radioactive isotope methods.

In general, after exposure of mice and rabbits to a dose of roentgen rays lethal to 50 per cent of the animals (LD-50) there is a steady decline in the red cell mass until about nine days following irradiation when recovery begins. The plasma volume at first drops and later rises, so that the red cell counts and hemoglobin values which are expressed per cubic centimeter of the blood sample are misleading. The drop in the erythrocyte mass is at first masked by the simultaneous drop of plasma volume, whereas later it is exaggerated by the rise of plasma volume above normal. Thus, the hematocrit readings are lowest on the seventeenth day. This explains the erroneous conclusions concerning irradiation anemia, arrived at by some earlier workers who assumed that the drop in red cell mass starts about four days after massive irradiation.

The possible causes of the postirradiation drop in red cell mass are as follows: (1) Death of aging erythrocytes. (2) Direct injury to mature erythrocytes. (3) Indirect destruction of erythrocytes caused by alterations in the reticulo-endothelial system or by liberated injurious chemical substances. (4) Loss of erythrocytes due to internal or external hemorrhage. (5) Decrease or failure of red cell production. Reticulocyte counts indicate that erythrogenesis ceases within a day after irradiation and remains absent or at a very low level for about twelve to fourteen days.

The authors demonstrate that increased permeability of the capillaries does play a part in the anemic process. It was found that not only foreign substances but also homologous plasma tagged with I^{131} and auto- and iso-erythrocytes tagged with P^{32} disappeared from the blood of irradiated animals faster than from the normal animals. It was also noted that following large doses of roentgen rays there was blood in the thoracic duct. The phagocytic reticulo-endothelial function was not markedly altered by irradiation. The authors advance the hypothesis that continuous leakage of erythrocytes through damaged endothelium to tissue spaces and lymph channels is a major factor in the causation of postirradiation shock and anemia.

There are numerous graphs and photomicrographs. —*J. G. Snead, M.D.*

Peltier, Leonard F., and Nice, Charles M., Jr. Irradiation of bone lesions in the presence of metallic intramedullary fixation. *Radiology*, Feb., 1951, *56*, 248–250.

A wax phantom containing a femur with a removable intramedullary nail was constructed in order to determine the shielding effect of such a nail. For the factors used, the area of bone cortex shielded by the described metallic nail received only 70 per cent of the amount of radiation as compared to the dose delivered to this area when the nail was not in place. A Victoreen dosimeter was used for measurements. It was concluded that, in order to deliver a satisfactory amount of radiation to the tumor cells in the shielded area, larger doses and/or multiple portals should be used.—*M. B. Goodwin, M.D.*

Taylor, Lauriston S. The measurement of x and gamma radiation over a wide energy range. (The Silvanus Thompson Memorial Lecture.) *Brit. J. Radiol.*, Feb. 1951, *24*, 67–81.

Taylor deals with the measurement of roentgen and gamma rays having energies from a few thousand to several million volts. His discussion is divided into four parts: (1) primary standards, (2) secondary standards, (3) utility instruments, and (4) special measurement methods and problems. Standardization and measurement of roentgen-ray dosage in the 100 to 200 kv. range has been quite satisfactory for the past twenty years. Most countries have had free-air standard ionization chambers comparing within less than 1 per cent in this energy range since 1930. The high degree of accuracy in comparison was possible because of an easily reproducible primary standard.

In measuring low voltage standards, difficulty is encountered in minimizing air absorption corrections. A modification of the guarded-field parallel-plate ionization chamber was developed and found suitable for measurement in the "grenz-ray" region. The radiation sources then available were the glass bubble-window tubes, operated at voltages of less than 15 kv. and with low tube currents. This is the only type of chamber which enables measurements to be made which are free of wall corrections. Calibration of many types of thimble chambers against this standard showed that the thin nylon wall chamber is the least energy-dependent of commercially available chambers. The unfiltered radiation from a beryllium window tube requires a correction of 25 to 40 per cent over the 10 to 300 kv. energy range. Filtrations of 6 mm. Al to 0.2 mm. Cu are needed to reduce calibration errors to clinical usefulness.

In the low energy region, a thimble chamber is extremely sensitive to the energy distribution in the beam. A reliable calibration can only be made when the tube is operated at constant potential and at the same exciting voltage to be used in the clinical application. No dosage measurements on the 10 to 20

kv. range are reliable unless made with a free-air chamber.

Recently renewed interest in the clinical use of very soft radiation, particularly the water-cooled, beryllium-window tube, has made necessary the accurate measurement of these standards. Numerous alterations in the guarded-field ionization chamber, chiefly in determining minimum dimensions, were necessary to meet these changing prerequisites. In dealing with very high dosage rates (in the order of 104 to 105 r/min.), the problem of securing saturation in a free-air ionization chamber is a serious one. To prevent recombination of the ions, the ionized volume was reduced by narrowing the beam size, thereby permitting complete ion removal with electrical fields of only moderate strength. It is stated that the absolute accuracy of a free-air chamber depends upon the cross-sectional area of its diaphragm.

In attempting to measure radiations up to 500 kv. energy, the free-air chamber becomes unmanageably bulky. This is overcome in part by elevating the pressure within the chamber, i.e., the plate separation can be roughly halved with ten atmospheres of pressure. At these pressures, a saturation value of the ionization current cannot be obtained directly because a significant fraction of the ions is lost by recombination. The magnitude of this loss can be determined by an extrapolation technique based on the Jaffé-Zanstra theory. Energies of the order of 400 kv. represent the higher limits accurately measurable without changing the design characteristics of the chambers used in the 200 kv. region. Free-air ionization chamber measurements in the million-volt region present serious problems yet to be solved. These problems assume a very practical aspect in determining the energy dependence of the many commercial radiation instruments now being manufactured. Determining the energy response of secondary standard instruments is difficult and must be calibrated using monochromatic radiation of many mev. range. Undersaturation in thimble chambers is a major obstacle to accurate measurement where high dosage rates (200 to 100,000 r/min.) are concerned. Vacuum chambers are being investigated as to a possible solution for making monitoring devices more acceptable from both the manufacturing and practical usage standpoints.

Secondary instruments such as pocket ionization chambers have shown a large variation in energy response. The stray radiation which they are expected to measure is of widely varying energies, and elimination of energy dependence is highly desirable. With changes which have been made in these units (possible elimination of supporting metal sleeves located in such a way as to contribute a large fraction of the ions measured), the energy dependence has been reduced to one-third or one-half its original value and they are still within practical manufacturing limits. Geiger counters have a large energy dependence, of a magnitude of about 300 per cent. Dosage rates significantly higher than 2 to 15 mr/hr. render the Geiger counter almost useless. By the proper choice of materials in the electrodes and materials surrounding the counter as a whole, this dependence can be decreased. Scintillation counters allow reliable radiation measurements to be made over wide ranges of intensity. Slight changes in calibration due to color changes occur but are of small degree and vary with the crystal employed. Fatigue effects in the crystals are negligible. Photographic emulsions have long been employed as a means of determining radiation intensity and recently renewed interest in their use has been noted. In badge form, they are popularly used in personnel monitoring. In general they have a large variation in energy response in the low kv. range. The response has been flattened effectively, thereby covering wider ranges of energy, by enclosing film packs in thin metal and moulding them over plastic cases. Alteration of developers and developing techniques has shown that the same emulsion will respond in different dosage ranges.

Other problems remaining to be solved involve the measurement of β-radiation from radioactive sources and accelerators. β-radiation cannot be described in terms of the roentgen unit or other units currently used to express radiations of different character. Measurements of radiations from cavity-ray tubes, betatrons and other pulsed sources present additional new problems in dosimetry.

Numerous graphs and tables illustrate the text.—*K. L. Krabbenhoft, M.D.*

McMILLAN, EDWIN M., BLOCKER, WADE, and KENNEY, ROBERT W. The r-unit at 320 and 160 mev. *Phys. Rev.*, Feb., 1951, *81*, 455.

The roentgen is currently used in two ways: as a measure of radiation dose, and as a measure of roentgen intensity. Pertaining to dose, it is quite well defined in terms of energy absorbed per gram of tissue and is determined by means of standard thimble chambers. Its definition in regard to roentgen intensity is less satisfactory. Originally, it was defined as the ionization, in air, due to secondary electrons in equilibrium with a primary beam of roentgen rays. Equilibrium is easily attained with low energy roentgen rays since the range of the secondaries is small compared to the absorption distance of the primaries in air. With high energy roentgen rays, this does not apply since this equilibrium no longer exists.

Therefore, the old definition must be abandoned and the authors question what the roentgen should mean in connection with the intensity of a beam of high energy roentgen rays. They suggest that the newer concept must apply to some specified setup of the ionization chamber and its surroundings. Because of the ambiguity in the use of the Victoreen thimble chamber by various workers, the roentgen has lost much of its value for roentgen-ray measurements in the mev. range. It should be replaced by

measurements in terms of energy flux, or "effective number of quanta" (the energy flux divided by the upper limit quantum energy).

The authors' proposed standard setup would consist of a Victoreen thimble chamber inside an open-ended lead cylinder with 1/8 inch wall thickness, 5/8 inch inside diameter, and of at least 2 inches length. This arrangement is easily reproduced. It should be placed with its axis transverse to the beam direction and at a sufficient distance from the roentgen source that the intensity is reasonably uniform over a region at least 1 inch in width. The total energy flux in a well collimated beam is measured and a Victoreen thimble chamber reading is made in the center of the beam. The flux divided by the area of the beam at the thimble gives the average intensity of the beam at this distance which, multiplied by a factor, computed from the measured angular distribution in the beam, gives the central intensity.

Calibrations of this sort for 320 mev. and 160 mev. energies were accurate to about 10 per cent. The roentgen-ray energies were accurate to about 2 per cent.—*K. L. Krabbenhoft, M.D.*

Odeblad, E. A technique of autoradiography. *Scandinav. J. Clin. & Lab. Investig.*, 1951, *3*, 151–156.

The author describes a technique of autoradiography that has been very satisfactory in investigations with P^{32}, C^{14} and S^{35}. The technique does not permit a maximum resolving power, but has the advantage of being simple and reproducible, permitting the preparation of large series of autoradiographs of standardized qualities.

There is a discussion of the special technique of the method with charts listing the properties of various autoradiographic emulsions and also a table giving the approximate exposure time for Gevaert no-screen roentgen film, two hours after administration of P^{32}. The time is correlated to the dose of P^{32} in millicuries per kg. of body weight and to the section thickness expressed in microns.—*T. J. Wachowski, M.D.*

van der Plaats, G. J., and Fontaine, J. Application de la technique d'agrandissement radiologique à l'étude des affections articulaires chroniques. (Application of the technique of roentgenographic magnification to the study of chronic joint diseases.) *J. belge de radiol.*, 1951, *34*, 203–219.

In order to detect articular lesions while they are small or incipient, the technique of roentgenographic magnification is applied, using the Philips 0.3 mm. focus rotating anode tube and a long object-film distance, as described by the senior author in a previous report. With this method, details not visible with the conventional technique can be clearly demonstrated. The results are illustrated by 9 case reports with roentgenograms taken with both the conventional and the magnification technique. Early or minimal marginal osteophytes, details of the articular surfaces, the subchondral areas and the periarticular soft tissues are shown more clearly than with the conventional methods. A tenth case illustrates a meniscus lesion. The technical improvement is ascribed not only to the magnification of detail but also to better contrast.

The article contains 19 well reproduced roentgenograms, a graph, and a summary of physical and geometrical data pertaining to roentgenographic magnification.—*Albert Oppenheimer, M.D.*

Krohmer, J. S., and McCarthy, William A. A simple laboratory setup for rapid measurement of β-ray dosages above 1 rep/sec. *Science*, March 30, 1951, *113*, 360–361.

To obtain dosage measurements on high flux beta-ray applications, the authors assembled a measuring apparatus of relatively simple design and high efficiency. This setup allows for calibration in about one hour as compared to the six hours required for use of the extrapolation ionization chamber devised by Failla.

The ionization chamber is illustrated and described in detail both as to construction and technique of operation. A sample curve is included which shows the calculation of radiation dose in rep/sec. at 1 mm. depth using a Ru^{106} source in a lucite phantom.—*K. R. Kaess, M.D.*

Gandini, Dario. Ricerche colecistografiche intorno all'azione delle onde corte sulla funzionalità vesicolare. (Cholecystographic investigations on the action of short waves on the function of the gallbladder.) *Radiol. med.*, March, 1951, *37*, 189–199.

Benassi, in 1929, performed a series of experiments for the study of the action of prolonged application of diathermy on the dye-filled gallbladder in dogs.

The author has decided to repeat these experiments, but by making use of short wave applications since, as is known, the very high frequency current of short waves produces a higher and more uniform elevation of temperature within the tissues than does diathermy. His primary interest was to investigate the effect of heat on the function of the gallbladder although it is probable that the short waves also exert a direct vibratory stimulation on the cells, resulting in certain chemical or physicochemical changes.

The problems studied were: action of the short waves (of a monochromatic beam of 6 meter wavelength) on the cholecystographic opacification, tonus, motility and emptying of the gallbladder; and difference of reaction to the stimulus in subjects of different constitution.

The investigations were carried out in 22 normal subjects of both sexes. The procedure was as follows: The dye was administered by the intravenous route; nine hours later a first cholecystogram was made followed by a first seance of short wave application of twenty minutes' duration; ten minutes later a second cholecystogram was made followed by a second seance of short wave application again of twenty minutes' duration; another ten minutes later a third cholecystogram was made, after which a fatty meal (1 egg yolk in 300 cc. of cow's milk) was given followed by several serial cholecystograms. The first cholecystogram showed the maximal filling of the gallbladder, the second and third the morphologic and functional alterations immediately after the short wave application, and the serial cholecystograms the time of the beginning and the duration of the emptying of the gallbladder with their possible modification. All subjects who on the first cholecystogram exhibited signs of a questionable organic lesion of the gallbladder were eliminated from further study.

Another group of 20 normal subjects was used for control, the only difference in the procedure being that from the ninth to the eleventh hour after the injection of the dye, cholecystograms were made every thirty minutes to determine the incidence and type of spontaneous variations without the stimulus of the short waves.

The following general conclusions were reached: The action of short waves on the sympathetic nervous system, and hence on the tonus of the gallbladder, is slight, occurs infrequently and manifests itself, according to the author's view, on the intramural portion of the gallbladder in an attempt to regulate its tonus. There is no action whatsoever on the motility proper or kinesia and thus on the emptying of the gallbladder. The only modification of the emptying may result from an eventual correction of the initial tonus of the gallbladder. The effect on the opacification of the gallbladder is mild, although a slight increase in the opacification is often observed. This latter effect varies in subjects of different constitution in the sense that a stimulation of the hyposthenic branch of the sympathetic nervous system raises the initially lowered tonus of the gallbladder.

The article is well illustrated with reproductions of illustrative cholecystograms.—*T. Leucutia, M.D.*

MANGIONE, GAETANO, CRINELLI, ARIO, and MASINI, GIANCARLO. L'attività farmacologica della morfina sulle vie biliari extraepatiche dell'uomo. Ricerche colecistografiche. (The pharmacologic action of morphine on the extrahepatic biliary passages of man; cholecystographic investigations.) *Radiol. med.*, April, 1951, *37*, 257–269.

A great deal has been written on the pharmacologic action of morphine on the biliary passages. The authors undertook the present study with the aim of ascertaining the extent to which the existing knowledge on this subject can be applied to man under physiologic conditions.

In general, the investigations fall into two periods. The first period starts with the observations of Kitakoji in 1930, and embraces the notable contributions of Shy (1932), Butsch and his co-workers (1936), Knepper (1937), Colp and Doubilet (1937), Sussman (1937), Ivy and his co-workers (1939 and 1947), etc. All investigators of this period are in agreement over the fact that morphine induces a marked hypertonus of the sphincter of Oddi which lasts several hours and is associated with marked increase of the intrabiliary pressure. The second period was initiated in 1945 by the French workers, the list of which includes the names of Caroli, Bergeret, Debouvry, Gilles, Varay, etc. These authors, besides confirming the observations of the investigators of the first period, have also noted (by simultaneous intubation of the gallbladder and choledochus) an increased distention with markedly delayed emptying of the gallbladder, a fact which they interpreted as being due to a hypertonus of the collum cysticus sphincter induced by the morphine. Moreover, they expressed the opinion that this latter effect is of greater importance than the action on the sphincter of Oddi.

A review of all the theories advanced during these two periods shows that the following effects have been attributed to the action of the morphine on the extrahepatic biliary passages: effect on the sphincter of Oddi resulting in hypertonus of the sphincter and obstruction of the choledochus; effect on the sphincter of Lütkens, resulting in marked hypertonus of this sphincter with obstruction of the communication between the gallbladder and the choledochus; effect on the gallbladder proper which according to some investigators is direct, being associated with inhibition of the tonus and kinesia of the biliary passages (Caroli and co-workers, Porcher and Varog), and according to others is similar to the effect of morphine on smooth muscle in general except that it is masked by the variation in the intrabiliary pressure (Ivy and co-workers, Sussman).

The present authors carried out their investigations by administering morphine in a carefully chosen group of 35 healthy subjects during various phases of cholecystography. Accordingly, they devised three tests, the technique of which was as follows: *Test A.* (5 subjects): (1) the dye was administered orally; (2) fourteen hours later a cholecystogram was made and 1 cg. of morphine injected subcutaneously; (3) ten minutes later a fatty meal was given and then cholecystograms made every twenty minutes during the first two hours and at gradually spaced intervals thereafter until

the gallbladder was empty. *Test B.* (15 subjects): (1) the dye was given intravenously and at the same time 1 cg. of morphine was injected subcutaneously; (2) four hours later again 1 cg. of morphine was injected subcutaneously; (3) eight hours after the intravenous administration of the dye the first cholecystogram was made followed (4) by administration of the fatty meal to study the evacuation of the gallbladder. *Test C.* (15 subjects): (1) the dye was given orally; (2) fourteen hours later a cholecystogram was made followed by (3) administration of the fatty meal; (4) when the gallbladder was reduced to about one-third of its original size, 1 cg. of morphine was injected subcutaneously; (5) forty minutes later a control cholecystogram was made followed by (6) intravenous injection of 10 cc. of 20 per cent dehydrocholin (Recordati); (7) thirty minutes later a final cholecystogram was made.

After discussing in detail the findings obtained with the three aforementioned tests and using numerous cholecystograms for illustration, the authors state that morphine is of definite value during cholecystography to establish (1) whether or not an impaired visualization of the gallbladder is the result of disturbing factors of the pressure equilibrium necessary for the filling of the organ (atony, hypotonus of the sphincter of Oddi demonstrated by test B); (2) whether or not a reduced opacification of the gallbladder derives from a diminished power of concentration of the mucosa or a decreased flow of the radiopaque bile (demonstrated by test B); and (3) whether or not the gallbladder has maintained its capacity to distend although in certain inflammatory forms this necessarily must be reduced (demonstrated by test C).

The conclusion is reached that morphine distends the gallbladder and does not impede its emptying; it facilitates the passage of the bile from the main duct into the biliary reservoir. This latter phenomenon is the result of the hypertonus of the sphincter of Oddi and the maintained perviousness of the communication between the choledochus and the gallbladder. Thus, the authors were unable to confirm the current opinion that morphine exerts a greater stimulation on the sphincter of Lütkens than on the sphincter of Oddi.—*T. Leucutia, M.D.*

Koch, Wilhelm. Die Verteilung von Peteosthor und seiner Hauptbestandteile Thorium X und Platin im heranwachsenden Organismus und der Einfluss von Thorium X auf das Fugenwachstum beim jugendlichen Kaninchen. (The distribution of peteosthor and its chief constituents, thorium X and platinum, in the growing organism and the influence of thorium X on epiphyseal growth in young rabbits.) *Strahlentherapie*, 1951, *85*, 253–289.

Twenty-six growing rabbits were subjected to various doses of peteosthor (which consists of a finely dispersed platinum salt, eosin blue and thorium X) and its constituents, singly or in combination with each other. The substances were administered in repeated doses in most instances. Subsequently roentgenographic, autohistoradiographic, counter-tube, spectrochemical and histologic observations were made. The findings indicate that:

The animals which received thorium X grew 30–50 per cent less in weight and length than the other animals. Thorium X alone was accountable for the changes observed in the skeletal system.

Thorium X showed an affinity for the epiphyseal plate. Widening of the epiphyseal cartilage and, more especially, of the preparatory zone of calcification was produced by thorium X.

The normal epiphyseal plate exhibited the greatest concentration of thorium X in the treated animals; the spongiosa, cortex, and the widened zone of preparatory calcification contained virtually none.

Treatment with thorium X carried out over many weeks produced roentgenologically demonstrable decalcification of the bones, to the point of causing spontaneous femoral fractures in 7 of 16 treated animals.

Platinum and thorium X distributions in tissues were independent of each other. Platinum was demonstrable only in the liver.

No pathologic change was demonstrated from thorium X in the blood, blood-forming organs, or the parenchymatous organs. The gonads showed the smallest content of thorium X of all tissues examined.

Pregnancy occurred in several of the animals. Thorium X was demonstrated in the cartilaginous fetal diaphyses and in the placenta. This is attributed to the parallel metabolism of calcium and thorium X which results in deposition of both in the fetal bones and freshly calcifying area in the placenta.

That thorium X localizes selectively in calcifying and ossifying tissues was also demonstrated clinically by the successful treatment of ankylosing spondylitis with thorium X. Administration of thorium X during pregnancy is contraindicated. Administration to children is also inadvisable.—*H. G. Moehring, M.D.*

Lucké, Balduin, and Schlumberger, H. G. Effects of roentgen rays on cancer. I. Direct microscopic observations on living intraocular transplants of frog carcinoma. *J. Nat. Cancer Inst.*, Dec., 1950, *11*, 511–543.

The effects of irradiation on living intraocular transplants of frog renal carcinoma were studied by direct microscopic observation. Details in the form and size of the tumor growing in the anterior chamber of the frog's eye, and the changes induced by

roentgen rays in various doses were visualized through the slit lamp microscope and photographed.

Three principal responses of irradiation to the tumor were observed:

I. Fragmentation, shrinkage, increase in granularity, and opacity of neoplastic outgrowths, with ultimate disappearance of the most actively growing non-vascularized parts of the tumor, the reduction of tumor to a fibrohyaline mass, or complete disappearance, were noted with a single dose of 6,000 r, or with doses of 7,000 to 12,000 r given in increments of 900 to 1,400 r.

II. With single dose of 2,000 r, the response was diphasic; gradual cessation of growth occurred, with progressive diminution in size of the tumor for about four weeks, following which rapid regrowth of the neoplastic tissue took place. All these tumors recovered and were transplantable.

III. With doses of 3,200 r in increments of 200 r on alternate days, no perceptible radiation effect was noted. In all instances a superficial irradiation was used with 50 kv., 4 ma, 0.2 mm. Cu filter with a half-value layer of 2.4 mm. Al.—*F. E. O'Neill, M.D.*

Merwin, Ruth, Algire, Glenn H., and Kaplan, Henry S. Transparent-chamber observations of the response of a transplantable mouse mammary tumor to local roentgen irradiation. *J. Nat. Cancer Inst.*, Dec., 1950, *11*, 593–623.

Mammary tumor implants growing in transparent chambers in the skin of mice were studied in vivo after irradiation with local superficial roentgen therapy. In vivo observations were also made of irradiated tumor implants on a normal bed and normal implants on an irradiated bed.

With dosages of 2,000 to 3,000 r, marked regression of the tumor occurred followed by regrowth. First a direct action of irradiation produced opacity within forty-eight hours, followed by an increased opacity on the third to fifth days which was believed to be an indirect response attributed to slow circulation. The tumor vessels narrowed for a week or more, but when growth was resumed, the vessels returned to usual size.

Regrowth tumors grew first at the same rate as non-irradiated tumors but since no new capillaries were produced, the blood supply became inadequate and growth was slowed. Irradiated vessels were unable to produce new vessels from an irradiated tumor, nor were vessels from an irradiated bed able to vascularize non-irradiated tumor implants.—*F. E. O'Neill, M.D.*